Shop-Floor Narratives:

How Six Workers and a Researcher Describe Learning Activities

Gustaaf de Man, B.I.E.

Department of Graduate and Undergraduate

Studies in Education

Submitted in partial fulfillment of

the requirements for the degree of

Master of Education

Faculty of Education, Brock University

St. Catharines, Ontario

Abstract

I am a part-time graduate student who works in industry. This study is my narrative about how six workers and I describe shop-floor learning activities, that is learning activities that occur where work is done, outside a classroom. Because this study is narrative inquiry, you will learn about me, the narrator, more than you would in a more conventional study. This is a common approach in narrative inquiry and it is important because my intentions shape the way that I tell these six workers' stories.

I developed a typology of learning activities by synthesizing various theoretical frameworks. This typology categorizes shop-floor learning activities into five types: on-the-job training, participative learning, educational advertising, incidental learning, and self-directed learning. Although learning can occur in each of these activities in isolation, it is often comprised of a mixture of these activities.

The literature review contains a number of cases that have been developed from situations described in the literature. These cases are here to make the similarities and differences between the types of learning activities that they represent more understandable to the reader and to ground the typology in practice as well as in theory.

The findings are presented as reader's theatre, a dramatic presentation of these workers' narratives. The workers tell us that learning involves "being shown," and if this is not done properly they "learn the hard way." I found that many of their best case learning activities involved on-the-job training, participative learning, incidental learning, and self-directed learning. Worst case examples were typically lacking in properly designed and delivered participative learning activities and to a lesser degree lacking carefully planned and delivered on-the-job training activities.

Included are two reflective chapters that describe two cases: Learning "Engels" (English), and Learning to Write. In these chapters you will read about how I came to see that my own shop-floor learning—learning to write this thesis—could be enhanced through participative learning activities. I came to see my thesis supervisor as not only my instructor who directed and judged my learning activities, but also as a more experienced researcher who was there to participate in this process with me and to help me begin to enter the research community.

Shop-floor learning involves learners and educators participating in multi-stranded learning activities, which require an organizational factor of careful planning and delivery. As with learning activities, which can be multi-stranded, so too, there can be multiple orientations to learning on the shop floor. In our stories, you will see that these six workers and I didn't exhibit just one orientation to learning in our stories. Our stories demonstrate that we could be behaviorist and cognitivist and humanist and social learners and constructivist in our orientation to learning. Our stories show that learning is complex and involves multiple strands, orientations, and factors. Our stories show that learning narratives capture the essence of learning—the learners, the educators, the learning activities, the organizational factors, and the learning orientations. Learning narratives can help learners and educators make sense of shop-floor learning.

Acknowledgements

I wish to acknowledge two special people who helped me with this project, my wife Jane, and my project supervisor, Dr. Michelle McGinn.

Jane I thank for the long walks where we discussed ideas about learning in general and shop-floor learning in particular. I thank her for the endless encouragement and support. This was participative learning at its best—we did it together!

I thank Dr. McGinn for two roles that she played. First, as my supervisor, I thank her for all of her on-the-job training and direction. And second, as a "coworker," I especially thank her for our participative shop-floor learning activities. You were always there when I needed someone to just "show me how."

I also thank the members of my thesis examining committee, Tony DiPettta, Dr. Michael Kompf, and Dr. Hugh Munby.

All of the above encouraged me to "press on." They structured the content of my learning activities. They facilitated my development. They modeled and guided new roles and behavior (since I was new to the academic community). They facilitated and negotiated meaning with me.

I finally thank Rufus, Blackjack, George, James, JJ, and Jean for telling me their stories of shop-floor learning activities and for allowing me to share them with others.

Thanks to all of these people. Each one of them is an educator, a coworker, and a co-learner!

Table of Contents

List of Tables

List of Figures

CHAPTER ONE: INTRODUCTION

This study documents a series of narratives about shop-floor learning activities. Six workers describe their learning activities in an industrial setting, and a researcher describes learning activities in his research setting. Shop-floor learning activities occur where work is done—on the "floor," not in a plant's training centre or at a community college. Like the workers in this study, I was also involved in shop-floor learning activities. My shop-floor learning activities began when I finished the coursework for my Master of Education degree and began the final requirement for graduation, that is, this research project. My shop-floor learning activities occurred at my desk in the basement, in the school library, at my computer, in my thesis supervisor's office (or on the phone with her), during discussions on my regular neighborhood walks with my wife, and sometimes even as I slept. Anywhere I was thinking about or working on my thesis, was my shop floor.

Discussions about learning and learning activities can be very confusing if the participants in the discussion have different definitions for these and related concepts. To avoid confusion, this study begins with the following definitions of learning and learning activities:

> We can define learning in a fairly traditional manner; that is, any sustained change in thinking, values, or behavior that is brought about by an experience. Adult Education, then, becomes the set of activities or experiences engaged in by adults which lead to changes in thinking, values, or behavior. (Cranton, 1992, p. 2)

"Learning as a process (rather than an end product) focuses on what happens when the learning takes place" (Merriam & Caffarella, 1999, p. 250). I am interested in the process—the set of learning activities or learning experiences. Dewey (1916) discusses

> the two senses of the word "learning." On the one hand, learning is the sum total of what is known, as that is handed down by books and learned men. It is something external, an accumulation of cognitions as one might store material commodities in a warehouse. Truth exists ready-made somewhere. Study is then the process by which an individual draws on what is in storage. On the other hand, learning means something which the learner *does* [original italics] when he studies. It is an active, personally conducted affair. The dualism here is between knowledge as something external, or as it is often called, objective, and knowing as something purely internal, subjective, psychical. (pp. 334-335)

Like Dewey, I am interested in what the learner *does* when he or she studies. This is what Lave and Wenger (1991) describe as "legitimate peripheral participation...an analytical viewpoint of learning, a way of understanding learning" (p. 40). This study describes and analyzes shop-floor learning activities or experiences, what six individual workers in an industrial setting, and this researcher in an academic setting, *do* as we learn.

I have not always been aware of, or paid attention to, the whole set of learning activities or experiences that people go through in their daily lives, either personally or professionally. For example, as a young immigrant boy, I thought that my parents' learning to speak English involved me teaching them English. Obviously, their learning English included many more activities and experiences than the activity of their young child coming home from school and teaching them what he had learned. Another

example comes from my professional life; as a training department manager, in my past work, I focused mainly on training, the learning activities that involved instructors teaching workers. But there are many more activities and experiences that lead to workplace learning in an industrial setting (Knowles, 1985; Malcolm, 1992; Merriam & Caffarella, 1999). Most recently, as a graduate student, I sought learning experiences that involved advice and instruction from either my professors, or from other scholars through their published works. But these are not the only activities and experiences that have led to my learning. Much of my learning about educational research, for example, has occurred outside formal settings.

I have offered examples of how, in the past, I have been unaware of the whole set of activities and experiences that lead to learning. Industry seems to have been similarly unaware when it comes to workplace learning. For example, Knowles (1985) states, "The HRD [Human Resources Development] practitioner who simply provides instructional activities is a quaint reminder of the old industrial age" (p. 24). The implication is that there is more to worker learning than "simple instruction" even though some practitioners continue to emphasize instructions only. Malcolm (1992) agrees and proposes some reengineering of corporate training to involve the "100 percent learning event," which he describes as,

> one that includes some traditional elements of formal training and a whole set of support for people while they try to apply new skills on the job. The learning event isn't over until the skill has been applied to real work. (p. 59)

Like Cranton, Malcolm emphasizes that training includes a whole set of learning activities. Like Knowles, he suggests that industry is not currently paying attention to the

whole set, the "100 percent learning event." A final example, from Merriam and Caffarella (1999):

> Whenever we ask adults about their learning, they most often mention education and training programs sponsored by the workplace, colleges and universities, public schools, and other formal organizations. They first picture classrooms with "students" learning and "teachers" teaching in a highly structured format. Yet when we ask these adults about what they have learned informally over the last year, they typically respond with learning activities outside of these formal settings. They discuss for example remodeling a house, which involved everything from reading and talking with friends, to conversations with carpenters, plumbers, and electricians....In considering the spectrum of learning opportunities available to adults, it is important to acknowledge all of these areas of learning, from the highly structured to the more informal ways adults go about learning. (p. 24)

Like Knowles (1985) and Malcolm (1992), Merriam and Caffarella describe adult learning as a "spectrum of learning opportunities" and they describe adults as being aware of only a subset of these activities. In my past work, I too have been unaware of many types of learning activities and experiences. This study attempts to examine and discuss not only a whole set of activities and experiences involved with shop-floor learning for six particular workers in an industrial setting, but also the set of activities and experiences that were involved with my learning to write this study.

This study is my narrative—I call it shop-floor narrative—about six individual workers' stories of learning activities in their industrial setting. The stories describe, from

their points of view, what happened as they learned to do their jobs. These stories are the basis for narrative inquiry, a way for researchers to help readers know about people through narratives based on their stories. Simply stated, "narrative inquiry is stories lived and told" (Clandinin & Connelly, 2000, p. 20). Based on an analysis of the workers' stories, I reconstruct their stories and present a narrative on how these workers describe learning activities. This narrative is structured around the key themes that were identified in the analysis and consists of direct quotes from the workers.

In narrative inquiry, the narrator chooses what to say and how to say it. Narrators tell stories differently. Narrators tell different stories. Readers come to know that a narrator's story is meaningful by becoming familiar with the narrator and the narrator's intentions. For this reason, I will not only tell you narratives about how the workers describe learning activities, I will also tell two of my own personal stories about learning activities. Using a scientific metaphor, I am the apparatus through whom you will learn about these workers. You will read about the workers' learning activities on the shop floor, my learning activities as I reflect on their learning, and my learning activities involved in writing this thesis.

In this study, like in other studies, you, the reader, will be presented with my findings, my narrative on how six workers describe learning activities. Unlike some other studies, in addition to the findings, you will get to know me, the narrator. By reading my narrative, and learning about me, the narrator, you will learn how these six workers and I describe learning activities on our shop floors.

Purpose of This Study

The main purpose of this study is to describe and explore, through narrative inquiry, how six industrial workers and a researcher describe their various types of shop-floor learning activities. This study also describes what these stories contribute to the body of knowledge about workplace learning and implications for understanding shop-floor training and employee development. Another purpose is to draw educators into these narratives so that I and these workers can have the opportunity to influence educators; so that educators of every kind can improve the learning activities that affect us. As a result, I will have achieved another purpose of this study: to help our industrial and academic organizations learn. I am not only interested in what the learners experience, I am also interested in the nature of the people inside the learners. In order to know what learners experience and the people inside the learners, it is important to read, or listen to, the learners' stories. Narrative is the means to these ends.

The Role of Narrative Inquiry

A purpose of this thesis is to encourage educators to improve (change) educational practice on the shop floor. "People change what they do less because they are given analysis that shifts their thinking than because they are shown a truth that influences their feelings" (Kotter & Cohen, 2002, p. 1). For this reason, I will show you how these workers and I describe our learning activities. Learning involves experience; some argue that learning is experience. "For Dewey, education, experience, and life are inextricably intertwined. In its most general sense, when one asks what it means to study

education, the answer is to study experience" (Clandinin & Connelly, 1994, p. 445). For Clandinin and Connelly, narrative captures the experiential quality of experience. For this reason, workers' stories and my narratives comprise this study's way of knowing about the experiential qualities of learning activities that take place on the shop floor.

I have worked for over 25 years in an industrial plant. In order to protect the confidentiality of the workers, this plant is called ACME Marine in this document. I have been involved in training and organizational development for almost half of my time at ACME Marine. My focus has been on training activities. I have spent my career supporting trainers and developing materials for classroom training or formal on-the-job training. I have paid little attention until now to informal learning, the learning that occurs without a formal teacher on the shop floor. I have also paid little attention to the learner, having focused mainly on training methods. Why this change in focus? Training hasn't always helped people learn, sometimes training efforts have even failed miserably. Because focusing solely on trainers and training activities wasn't effective, I decided to try to understand learners and their learning activities.

In this study, I will introduce you to a group of workers who do similar work in different areas of an industrial plant. I will weave their stories together into a narrative about learning activities. And I will describe each of their stories individually. In this document, I will also include stories about two of my learning experiences: learning English and learning to write. Through this narrative, you will see how my experiences with shop-floor learning activities affect how I interpret the workers' stories about their shop-floor learning activities.

As a young child, I thought that learning required a teacher. I thought that training was the only type of learning activity. As you will read in my first reflective chapter, this shaped the way that I approached my job at ACME Marine, and the way that I initially approached this study.

My second reflective chapter is about me, a graduate student learning to write this thesis. I have experienced a lot of difficulty with the writing process. Much of this difficulty had to do with how I understood learning. I thought learning was at the receiving end of training and instructional activities. I did not understand the importance of other types of learning activities, like trial and error, in learning (and writing). I sought formulas and linear processes. I believed that if I faithfully followed step 1 by step 2 and step 3, I would be done in a predictable number of days. Perhaps this mistaken understanding is due to my engineering background, where much of my school and work experiences have involved planning and prediction. In addition to the problem of being unfamiliar with writing, another difficulty was having limited contact with my Master of Education (MEd) peers and professors. I work full-time in industry, so I am at school mainly at night. Consequently, I am unable to just drop in on professors during office hours, or become involved in the "peer support groups" that usually meet during the day—important learning activities that contribute to learning. This would be similar to situations where the six workers were unable to discuss their problems with coworkers. The advantage of my having these problems is that learning to write the proposal and later the thesis took me a long time, so I am able to more fully reflect on and describe my learning experiences than someone who is more comfortable with the writing process.

My reflective narratives will help you understand about me so that you can better understand how I interpreted the six workers' stories about learning activities on the shop floor.

Background to the Problem

Industry is changing rapidly. Because of this, there is an increasing need for worker expertise (Chapin, 1995; McGraw & Forrant, 1992; Toracco, 1999). As a result, workers' training and learning is very important to industry (Van der Krogt & Vermulst, 2000). Industry spends $50 billion per year on formal training and education, and $180 billion on informal on-the-job training (Rowden, 1996).

Most people equate learning with training (Merriam & Caffarella, 1999), and in industry, most people think of training as formal off-the-job or planned in-house instruction (Black, Zenner, & Ezell, 1996). But is this how people in industry really learn? An under used resource for exploring this question is the shop-floor workers themselves. Traditionally, shop-floor workers have been studied by industrial engineers (efficiency experts) who have focused on instructional approaches, doing to, rather than with learners. However shop-floor learning occurs in a number of different ways. I have developed a typology of shop-floor learning activities. The typology provides a framework for examining learning activities. Later in this study, the types of activities within my typology—on-the-job training, participative learning, educational advertising, incidental learning, and self-directed learning—will be discussed.

Shop-floor learning has had a shift in focus—from training, what trainers do—to learning, what learners do (Van der Krogt, 1998). By focusing on all of the learner's

learning activities, organizations improve employee learning. "A labor force that has learned how to learn and continues doing so can give a company a powerful edge" (Rowden, 1996, p. 3).

One of the things that Human Resources Development departments are responsible for is improving worker training and education within industry. Many believe that the purpose of these departments is to improve worker performance, others believe that the focus should be to support individual development (Rowden, 1996). Either way, it would be helpful to understand all of the learning activities involved with learning and improved performance.

There is an abundance of research on elements of what people do during training and learning in industrial settings. People have studied on-the-job training (Black, Zenner & Ezell, 1996; de Jong, 1991, 1996; Rothwell & Kazanas, 1990; Scribner & Sachs, 1990), situated learning (Lave & Wenger, 1991), informal learning (Marsick, 1988), and self-directed learning (Clardy, 2000; Tough, 1979), among other topics. People have studied subsets of shop-floor learners' activities, but there is little research on the learners' whole set of learning activities.

There is also little research that describes the person inside the shop-floor learner. There is an autobiography by an industrial worker—Rivethead: Tales From the Assembly Line (Hamper, 1986). It is a narrative about what the author thinks and feels about work inside an automotive assembly plant. This study attempts to discover not only what learners do but also who they are. Narrative inquiry provides a means to uncover and present these stories. Educators are interested in helping people learn. A personal

connection with real learners may help educators learn about and improve learners' learning activities.

Rationale for the Study

In order for educators to shift their attention to the whole set of activities that lead to shop-floor learning, it might be useful for them to be introduced to the stories of six individual workers and a researcher so they can have knowledge of not only a whole set of learning activities, but also knowledge of and empathy for the workers and researcher themselves. With this knowledge and empathy, learning activities and learning can be improved. As a result of improved learning, the learners, their organizations, and educational theory can benefit.

Questions to be Addressed

What are the workers' and my own stories of learning activities in our respective industrial and educational settings? What are the differences in our descriptions of the best and worst cases of learning activities in our settings? These are the questions that guide this study.

Importance of the Study

This study is important to industry. It spends $50 billion per year on formal training and education and $180 billion on informal on-the-job training (Rowden, 1996).

It is possible that these dollars are misdirected. Instead of addressing the problem of formal worker training, perhaps corporate training efforts should also focus on understanding workers' informal learning experiences. If this study finds that informal learning activities are unsupported and frustrating in industry, workers and their companies will benefit from this newfound awareness. "An awareness of informal learning can enhance learning in organizational settings" (Boekaerts & Minnaert, 1999, p. 534).

Graduate students like me might also benefit from this study. Learning is to a student like water is to a fish. It's all around us. We don't think about it. But maybe we should! Our learning too, continues outside the library and the classroom and involves a whole set of activities and experiences to which we might not be paying adequate attention.

Educational researchers may benefit from access to a learning situation to which they might not otherwise have access. Most educators cannot access or establish rapport with a meaningful sampling of industrial shop-floor workers. Some may wish to use this project's narratives to explore academic theories about teaching and learning. Others may wish to conduct additional narrative research and obtain the stories of other learners. Their questions would be different. How does a teenager, a university student, or a displaced worker describe the activities that lead to their learning? Perhaps researchers might ask themselves, "Am I aware of all of my students' learning activities and experiences?" As a result, educators and educational researchers could engage and involve learners in discussions about their learning.

Scope and Limitations of the Study

This study involves a group of shop-floor workers who do, relatively speaking, the same thing. They operate highly technical manufacturing machinery. This study is set in an industrial setting where the primary problems and tasks are technical. The language is technical. The challenges are technical.

The workers in this study operate the most complicated equipment at their plant. These workers have gravitated toward operating complex technical equipment. They have worked for ACME Marine for many years, beginning with routine tasks and progressing toward these highly complicated tasks. This study does not include simple, monotonous assembly work and the people who do those jobs. I am interested in studying learning. With simple jobs, the learning process takes a few days, which is not enough time for people to describe the process very well. This study does not involve skilled trade persons, the highly skilled and trained electricians, toolmakers, machinists, and millwrights. Skilled trades workers have typically learned in a formalized apprenticeship. I am interested in workers' everyday, without-a-teacher learning because such learning is ubiquitous in industry, but has received scant attention from researchers or educators.

Outline of the Remainder of the Document

This is a narrative study. I am the narrator, and as such, part of my job is to reveal more of myself to you, the reader, than what you would expect to find in a traditional study. Who I am makes a difference to how I retell the story (Clandinin & Connelly, 1994). I plan to reveal myself to you mostly in two reflective chapters. Researcher

Reflections I, entitled "Learning Engels," is a story that begins when I was a young boy who thought that he was teaching his parents English. Researcher Reflections II is called "Learning to Write" and is a reflection about learning to write this study. These chapters are set out in Arial font to distinguish them from chapters 2 through 5, which focus more directly on the six workers.

In chapter 2, the literature review, I will address the literature on shop-floor learning activities. In that chapter, I have constructed a number of cases that have been written from a worker's point of view. These cases describe the various elements of a shop-floor typology of learning activities that I developed in order to more easily discuss the similarities and differences between the various types of shop-floor learning activities. Because these cases are based on the literature, most of them will describe what workers do; the literature contains very little about the workers themselves. Nevertheless, you will gain familiarity with various industrial learning activities.

In chapter 3, I will discuss my research methods in greater depth. This is a second opportunity for me to convince you of the merits of a narrative approach, if you still have doubts.

Chapter 4 contains my findings. If you have already leafed through it, you will have noticed that it is in the form of a play—reader's theatre to be specific (Donmoyer & Yennie-Donmoyer, 1998). This is the most novel aspect of my work. I chose reader's theatre because it lets the narratives flow more smoothly than would a more traditional qualitative document. I do not pretend that this thesis is the workers' story, however. As in all research, it is my retelling of their stories. I have chosen what to include, and what not to include. Although the words are direct quotations from the workers, I have

sequenced the stories in a certain way, and I have added dramatic sequences that are designed to engage you and arouse your interest. This readers' theatre is a representation of the six workers' stories, and it means something to those workers. I strongly believe that there is something important to be learned through my telling of the workers' stories.

In chapter 5, I summarize the workers' stories, draw some connections to the literature, and point to some theoretical developments of this work. In the implications section, I also express my hopes for the future—for workers, for graduate students, supervisors of workers and graduate students, educators, educational research, and for learning narratives.

This document as a whole is itself a narrative. Its purpose is to describe and explore, through narrative, how six industrial workers and a researcher describe their various types of shop-floor learning activities. You will read about six workers and me. You will learn about our learning activities and about us as people. I hope that these stories will influence your feelings about us and our learning activities, and that these feelings will prompt you to think more about learners when you are engaged in educational activities.

Researcher Reflections I: Learning Engels

"What did you learn today?" How many years has it been since someone asked you that question? My mother frequently asked me what I had learned when I came home from the kindergarten class at Consolidated School. We had newly arrived in Canada, and my parents were as eager to learn "Engels," Canada's English language, as I was to learn to read, write, and do arithmetic.

Before immigrating to Canada, my parents took English classes in the Netherlands, and now, I thought, they were continuing these classes through me. Of course, I eagerly taught everything I had learned from my teacher, Miss Ogden. My error, however, was that I thought I was my parents' only "teacher."

Early in my life, I had the understanding that people only "learned" in school-like situations. This understanding continued to have a significant impact on my view of the world and my view of the nature of knowledge and learning until only recently. Only now, as I reflect on what actually might have happened during my childhood, do I realize that "Guusje, the little teacher" was more a mistaken understanding, and in my mind rather than in reality.

I thought that I was my parents' only source of knowledge. They did not go to school to learn English, but I did. Therefore, they must have learned a lot from me. I imagined that every evening we sat at the kitchen table practicing speaking, reading, and writing English. But as I try to remember specific examples of the things that I taught them and the nature of those teaching experiences, I can't recall even one.

I now recall, however, that their learning included more than just instruction from their 5-year-old son. They bought a television, even when money was tight. Watching it would help them with their English. They had the local newspaper delivered to the house, so they could practice their reading. They made a point of getting to know our Canadian neighbors, so they could practice speaking English. (They were especially fortunate that these neighbors were so accommodating and helpful.)

My parents used many resources and were assisted by many people. Their learning occurred outside school, in the environment where they lived and worked, and without a formal teacher.

Learning "Engels" was not the only experience that shaped my understanding of the nature of learning. There are some other reasons that I believed that learning only happened in schools.

When I think of my life "before school," my parents' daily question was, "What did you do today?"

I did so many things.

I went all day without wetting my pants!

One day after asking my Oma to get my little plastic shovel, I ran outside to help some workers at a construction project down the street by shoveling sand into their freshly mixed concrete. I wondered why they were so upset with me for helping them.

After practicing for weeks, and having older children show me how, one day I finally was able to say, "I tied my shoelaces by myself."

Before school, I did things, I went places, I saw people, I played games and made pictures, but I did not think of these as "learning" experiences. They were just fun things that I did. I do not remember learning, but I do remember exploring, being curious, experimenting, building forts, and racing toy cars. When I started school however, although I still did all of these things, questions about school always included the word "learn," while questions about play always included the word "do." This differentiation between doing and learning resulted in a false dichotomy in my understanding of learning as something that was separate from doing. Learning activities had to include a teacher.

This phenomenon of artificially separating experience and learning also occurs now that I am no longer in school (at least not full-time). I cannot recall the last time someone asked me, "What did you learn today?" Instead they ask, "What did you do today?"

In the 20th century, life's central activities—playing, learning, and working—were separated (Brown, 1999). However, at least for me, they happen simultaneously. I learn as I work. I learn as I play. I have never "been completely trained" in something and then gone on to just do it. I have learned more informally from friends, co-workers, and books "on-the-job" or "during-the-game" than from all of my teachers, in all of my classrooms.

Another source of my working/learning/playing understanding resulted perhaps from the interests of those in my MEd classes. The other students were mostly teachers and nurses who were interested in teaching. Little wonder that I was initially focused on the teaching role in learning situations, including

industrial learning situations.

As a child and well into adulthood, I understood learning as involving only classroom activity that is led by a teacher. In the next chapter, I explore the literature and show how it presents learning in an industrial setting. Later in this thesis, I document the ways that six workers describe learning activities.

CHAPTER TWO: REVIEW OF LITERATURE

The purpose of this study is to document and examine how six industrial workers and a researcher describe shop-floor learning activities. For the six workers, the shop floor is located in a manufacturing plant. For the researcher, the "shop floor" is in his home and other settings where he writes his thesis. I examine the research and find that people in industry often think learning happens in the classroom. However, the empirical evidence shows that most industrial learning activities happen on the shop floor.

The literature categorizes learning activities in a variety of ways, based on where the learning occurs (Merriam & Caffarella, 1999), the formality of the learning (Marsick & Watkins, 2001), the intention of the learner (Rogers, 1996), the source for direction or guidance (Rogers, 1996), the politics of the organization (Washington, 1996), the philosophy of the approach (Merriam & Caffarella, 1999), and the structure of the instruction (de Jong, 1991, 1996; de Jong & Versloot, 1999a, 1999b). This study is focused on shop-floor learning, so a framework needs to categorize the various types of learning activities that occur on shop floors. The above frameworks do not address shop-floor learning directly.

I developed a useful framework for shop-floor learning activities that is based on what I call the primary educator and the nature of the learning activity. When categorizing a learning activity, one asks, "Who is the educator in this activity and what is the nature of the activity?" On the shop floor, the educator and the related educational activity present themselves in a variety of ways. Trainers provide step-by-step instructions. A coworker answers questions, shows how, or provides encouragement. A poster reminds the learner to "be safe." An activity incidental to learning teaches the

learner something unexpectedly. The learner directs his or her own learning when seeking answers to questions or when deliberately practising a new skill. Since learning activities can have multiple educators, my typology identifies the primary educator. For example, on-the-job training could involve a trainer, learners, and coworkers as educators. The trainer provides instruction. A coworker or another learner might answer a question related to the trainer's instructions. The learner might seek to know something beyond the scope of the trainer's instructions. On-the-job training can have multiple educators, but the primary educator is usually the trainer.

Not only does my typology help categorize the different learning activities that occur on the floor, but also the typology might also be useful in predicting whether or not shop-floor learning will be more or less successful in one situation over another. Perhaps future research will determine that learning activities are generally more successful if the learner is an active educator. Or it might determine that when there are multiple educators in a situation and multiple strands in a learning activity, that learning is generally more successful. But before theory can make such prediction, we need to be aware of and know more about the different kinds of learning activities.

I have developed a series of cases, based on the literature, to describe each of these types of shop-floor learning activities.

How Industrial Workers Learn

What types of learning activities do you think occur in industry? What do you imagine most people working with or in industry think? Most people equate learning with formal training and education programs (Merriam & Caffarella, 1999, p. 24). In a 5-year

case study of on-the-job training in a factory stockroom, Scribner and Sachs (1991) wanted "to test the long-held assumption that schooling is necessary for effective job performance" (p. 1). Malcolm (1992) states that this assumption is rooted in "the old training paradigms" where people were first filled with skills and knowledge and then put to work. He goes on to ask, "How can we possibly hope for order of magnitude improvements in competence if we continue to focus all of our energy on improving formal training programs?" (p. 59). According to Zemke, "When training is mentioned, most people think of formal off-the-job or planned in-house classroom learning experiences" (cited in Black, Zenner, & Ezell, 1996, p. 590). People in industry think of formal training when they think of learning activities.

People have generally assumed, rightly or wrongly, that industrial workers learn through formal training programs. However, three workplace trends are changing that perception:

1. People are beginning to recognize that most learning occurs on the job.
2. Consequently, the educational focus is changing from "training the worker" to "helping the worker learn."
3. Due to changes in technology, there is an increasing need for worker expertise, expertise that is primarily developed on the job.

Regarding the first trend, the following quotation highlights that workers learn mostly on the job.

> When you ask workers if they can do their jobs well, you get an almost uniform answer – "Yes." When you ask whether they were trained by their

> employer to do the jobs – the most common answer is "No." This suggests how little employer training is provided....It also suggests something far more important: most people must be good learners. Most people have taught themselves (with help from co-workers) how to do their jobs and do them well! (Turk, cited in Chapin, 1995, p. 163)

Workers learn to do their jobs even if they have not participated in training activities. If they are not trained, how do they learn? Lave and Wenger (1991) have spent many years studying how workers acquire knowledge and skill from their co-workers. They have developed a way of theorizing learning activities based on the notion of "legitimate peripheral participation."

> By this [legitimate peripheral participation] we mean to draw attention to the point that learners inevitably participate in communities of practitioners and that the mastery of knowledge and skill requires newcomers to move toward full participation in the sociocultural practices of a community. (p. 29)

Workers learn inside the informal social work groups to which they belong.

Tough's (1979) research also supports the contention that relatively little is learned through formal classroom training. He found that only 20% of adults' learning efforts are guided by courses, professionals, or professionally developed materials, while 80% of learning efforts are self-planned, or planned by nonprofessionals. Twenty years later, Clardy (2000), in his review of the literature, confirms that self-directed learning is commonly used by adults and that job-related or vocational issues were the most frequent foci for self-directed learning projects.

On-the-job training (both formal and informal) accounts for 75 to 90% of tasks that are learned (Black, Zenner, & Ezell, 1996; Malcolm, 1992; Rothwell & Kazanas, 1990). De Jong (1991, 1996) says that on-the-job education comprises at least 50% of all learning efforts and that 87% of skills acquired in off-the-job training are lost in practice without on-the-job supervision.

People are beginning to recognize that most learning occurs on the job. As a result, the second trend in workplace learning has been a shift in focus from training to learning—from what trainers do to what learners do (Van der Krogt, 1998). Malcolm (1992) thinks the focus needs to be on the "100 percent learning event" and suggests that companies need to provide people with the support they need—information, advice, training—so they can begin work immediately and learn as they perform their jobs. Knowles (1985) agrees with this when he advocates employing a "HRD [Human Resources Development] specialist who manages a system of learning resources" (p. 24) rather than concentrating efforts solely on training activities. The second trend is a shift of focus from training workers to helping workers learn, helping them on the job.

Attention is also shifting to on-the-job learning because of yet a third trend. There is an increasing need for worker expertise, expertise that is developed on the job.

> A worker's ability to solve problems, or even the number of times in a day that she is called upon to solve them...comes from the worker knowing who [sic] to turn to when she does not have an answer, what to keep an eye on to make sure that everything is operating smoothly, and when to make adjustments in what she is doing. This is true whether she is tightening a nut, watching the ink level of a press, or creating a precision part with a CNC [Computerized Numerical

> Control machine]. The mental labor required of workers in the three industries studied [machining, automotive repair, and printing and graphic arts] is taking the place of much of the brute strength and manual work required in the past. (McGraw & Forrant, 1992, p. 8)

The increasing complexity of technology, the need for increasing workplace flexibility, and the ability to adapt to unforeseen situations are all driving the need for more skilled workers, skilled workers who acquire those skills on the job (Chapin, 1995; McGraw & Forrant, 1992; Toracco, 1999).

People are now beginning to recognize that most professional or job-related learning occurs on the job and that learning needs to be integrated with working (Torraco, 1999), especially in an industrial setting. People are beginning to focus their attention on helping the worker learn, instead of on training the worker. This is a good thing because there is an increasing need for worker expertise, expertise that is primarily developed on the job.

I have shown that workers learn on the job. The next section will explore how workers learn on the job, providing a typology of shop-floor learning activities.

A Typology of Shop-Floor Learning Activities

I have dispelled the notion that learning in an industrial setting occurs primarily in the classroom. Most learning activities occur and need to occur on the job, where the work is done. In order to conceptualize the different ways that learning occurs, theorists have developed frameworks that categorize the different types of learning situations.

Merrriam and Caffarella (1999) developed a typology that has learning occur in three settings: formal institutional settings, nonformal settings, and informal or self-directed settings.

In formal institutional settings, learning occurs in the classroom. People learn in various ways—from lecture to small-group interaction. In recent years, technology has changed the nature of formal learning to include learners in computer mediated environments—at work, or at home. Noneducational organizations, including industrial organizations, whose primary purpose is not educational but that view education as an allied function, are included in the "formal settings" category. In these settings, more often than not, Merriam and Caffarella said educational activities are referred to as "training" or "performance improvement programs" (p. 28).

In Merriam and Caffarella's nonformal category, learning takes place in community or indigenous settings. People gather in community churches to overcome racial hatred or inequality. Men and women learn to read and write. Farmers are introduced to new methods. The educational focus is social action or changes directed at improving some aspect of the community. Indigenous learning is linked with a specific culture and involves learning about the culture.

Merriam and Caffarella's third category is the self-directed or informal context. What makes this type of learning different from the other two is that the learning often takes place in learners' natural work settings and the learning is initiated by the learners themselves. "Although well accepted today as the way most learning happens, most adults do not even recognize they are learning even when they are actively engaged in

informal or self-directed learning activities at work or at home" (Merriam & Caffarella, 1999, p. 32).

Rogers's (1996) model describes learning as intentional or nonintentional from either the learner's point of view or the learning source's point of view. The learning source is the educator; it is the teacher, group, or organization that assists the learner. When both the learner and the educator are involved intentionally, learning is either formal or nonformal. When only the learner's involvement is intentional, then the learning is self-directed. If only the educator is involved intentionally, then the results are described as campaigns, propaganda, or advertisements. If neither the learner nor the educator is involved intentionally, then the learning is incidental. I will not use Rogers's ideas of intentionality in this study, but I will develop his idea of the learning source by considering the educators involved in learning activities.

In an article that was part of the literature review of a larger research project, de Jong (1991) attempted to classify the various forms of industrial on-site training. He categorized on-site training as on-site practice, on-site instruction, or on-site study. During on-site practice, "workers learn from the work itself—that is, they learn by doing" (p. 308). On-site instruction involves a superior teaching "a skill at the workplace on the basis of an explicit task analysis and according to a step-by-step method" (p. 310). With on-site study, "study by the employees, rather than practice or instruction, constitutes the central training activity" (p. 311).

As evident in the above frameworks, there are several key considerations for describing workplace learning activities. The first is the setting where learning takes place. It can be off the job as in formal classroom training. It can be on the job, where the

work is done, as in informal or self-directed contexts (Merriam & Caffarella, 1999). Finally, it can be around the job, in parking lots, entrances, and aisles as is the case with campaigns in the form of posters and memos (Rogers, 1996). This study focuses exclusively on the shop-floor setting, learning that occurs on or around the job.

The second consideration is the educator (or source of learning direction according to Rogers, 1996). Teachers primarily direct the learning in classrooms and during formal on-the-job training. Learners learn primarily from their work group in informal settings. Management is usually the educator involved in educational campaigns and advertisements, but unions and other organizations could also be involved. Experience itself is the primary educator in incidental learning. Finally, the learner is the primary educator in self-directed learning.

Table 1 lists the various primary educators on the shop floor and describes the nature of the learning activities in which they are involved. I created this framework for this study in order to identify and explore different types of shop-floor learning activities in further detail. There are five main types of learning activities that occur in shop-floor learning: on-the-job training, participative learning, educational advertising, incidental learning, and self-directed learning. "On-the-job training" involves instructors or instructions that teach the learner how to do an aspect of the job. The nature of this activity is instructing or reading instructions. With "participative learning," the workgroup community is the educator. Novice workers learn from those who have more expertise by participating in the activities of the workgroup. Educational advertising involves people's attempts to educate the worker through slogans and signs posted

Table 1

Typology of Shop-Floor Learning Activities

Name	**Primary Educator**	**Nature of Activity for the Learner**
On-the-Job Training	Instructor/ Instructions	Receiving or Reading Instructions
Participative Learning	Workgroup Community	Participating
Educational Advertising	Management (or Unions)	Reading/Watching
Incidental Learning	Experience	Experiencing
Self-Directed Learning	Learner	Constructing

around the job. Workers learn by reading posters or watching videotapes (e.g., Safety Videos). Incidental learning occurs when experience itself is the educator. Learners learn as they engage in incidental activities. They learn by experiencing. Finally, the learner is the primary educator during self-directed learning. It occurs around the job and involves learners seeking answers to questions or attempting to master skills on their own. The learner is constructing an understanding or skill.

During any learning interaction, the learner can be involved in all of these activities—being instructed or reading instructions, participating, reading or watching, experiencing, or constructing. These categories are not mutually exclusive. As with all typologies there is overlap, but the typology provides a way to focus on the different aspects of shop-floor learning activities.

In order to more fully describe these five types of learning activities— (1) on-the-job training, (2) participative learning, (3) educational advertising, (4) incidental learning, and (5) self-directed learning—I have found or developed cases for each type of activity. They are based on actual cases or articles from the workplace learning literature. Each case is presented in the first person, from the learner's point of view, since this project is attempting to describe how learners experience their learning activities. I have tried as much as possible to retain the original wording so as not to add my biases to those of the authors. These cases are useful to the reader in that they not only illustrate, in practice, what's under discussion in theory, but they also put a human face on the types of learning activities by helping the reader hear the human voice of the person involved in the case. The cases make similarities and differences more apparent. Written as narratives the cases make the learners' stories compelling.

On-the-Job Training Activities

De Jong (1991, 1996) has done considerable work in the area of what he calls on-site training. His article was the literature review of a larger research project at the University of Utrecht. His article attempts to clarify the various forms of on-site industrial training. He says:

> on-site training includes activities and conditions that are aimed at increasing the competence of a company employee, [are] relate[d] to tasks for which an employee is or will be held responsible, and are located in the employee's immediate (or future) job setting. (p. 307)

He categorizes on-site training as on-site practice, on-site instruction, or on-site study. During on-site practice, "workers learn from the work itself—that is, they learn by doing" (p. 308). For our purposes, this is a "Participative Learning Activity," which is discussed in the next section. On-site instruction involves a supervisor teaching "a skill at the workplace on the basis of an explicit task analysis and according to a step-by-step method" (p. 310). What de Jong calls on-site instruction is described in Case 1, which is based on a case study of a structured on-the-job training program (Black, Zenner, & Ezell, 1996, pp. 591-595). Black et al.'s description does not provide detail about the actual instruction process so I have used a section of de Jong's (1991) article, which describes the step-by-step training method involved in this training program (pp. 310-311). With on-site study, "study by the employees, rather than practice or instruction, constitutes the central training activity" (p. 311). Notice that de Jong describes on-site study as a training activity. This is the basis for Case 2, which is also presented in this section. Case 2 describes a form of on-the-job training that occurs on the job, and is

directed by a training contract. In this case, rather than using instruction as the methodology, the learning approach is one of study. It is taken from de Jong's (1991) article about on-site training (pp. 311-313). This is not an example of self-directed learning, since the primary educator is a teacher who structures the study program. This illustrates what Merriam and Caffarella (1999) describe as confusion over the meaning of self-directed learning because "incorporating methods of self-directed learning into formal and informal settings has become a major focus of practice for some adult educators" (pp. 32-33). Self-directed learning, where learners direct their own learning, will be discussed in a subsequent section.

Case 1: Learning to use a torque wrench. I work for a company that designs and manufactures custom-built coil processing equipment for customers who include manufacturers for the appliance and automotive industries. I work in assembly where we take machined and welded components and assemble the company's products by using threaded industrial fasteners (nuts and bolts).

I learned how to use a torque wrench from my group leader who used a technique called Structured On-the-Job Training (SOJT). Prior to my training, I used a conventional wrench to tighten fasteners, but there was no objective measure of the torque (tension or clamping force) applied to the nut and bolt. This torque was found to be important, so the company decided to begin using torque wrenches in the assembly process. A torque wrench is a wrench with an indicator that displays the torque that is being applied to a fastener. The purpose of the SOJT program was to train us to use a torque wrench during the product assembly process.

My group leader taught me how to use the torque wrench. He had a kind of crib note in his pocket, the job instructor card. He used it to remind him what to do prior to and during my training. On one side of the card, four steps outlined the preparations that were to be made prior to the instruction. On the other side, steps described how the instruction was to be given.

He taught me to use the torque wrench on a machine that I was working on that day. He first showed me how to use the torque wrench. I watched him complete the entire task. He checked to make sure that the torque wrench was working properly. Then he placed the torque wrench on a fastener, and evenly pulled on the wrench's handle until its display indicated the desired torque. He next explained the key points—how to position the wrench, where to hold it, how to zero it, how to pull, etc. Then I watched him do it again. Then he let me do the simple part of the job on my own—evenly pulling on the wrench's handle. After that, he helped me do the whole job. Finally, once he was satisfied with my performance, he put me to work on my own.

Case 2: On-site study at Dutch Railways. I am a maintenance mechanic at the signals department of Dutch Railways.

The training largely takes place at my place of work and consists of the more or less independent execution of assignments. This involves tasks that are part of the function for which I am being trained. These separate tasks are invariably part of a meaningful unit. In other words there are no separate tasks as such. The complexity of my tasks is often such that preparation is in the form of a theoretical assignment or a more practical exercise. I need to master a complex keyboard, for example. For me to learn this task, some practice is indispensable. For this reason, the assignments at my

workplace are often preceded by study or practice assignments that I carry out at home or in our practical training room. There is always a direct connection with my actual work.

Sometimes I receive, via a method of demonstration and practice, instructions from the training supervisors (employees experienced in the functions for which I am being trained). However the training supervisor is not a constant provider of explanations. Sometimes I am referred to manuals or other staff for relevant information. My learning responsibilities are laid down in a supervision contract. I am responsible for my own learning process. My learning targets are set by management, but I am expected to show initiative in reaching those targets through the use of structures and materials developed for that purpose. My training supervisor has the task of supporting me in that process.

Not only am I directly involved in the training itself, I am also on a steering group that consists of training personnel and representatives like me from my department. Our responsibility is for the maintenance of standards. As a result, our training course is regularly assessed and adjusted where necessary.

Training materials are of crucial importance for the quality of the training. These may be the same materials that are used in the signals department, or they may consist of practice manuals. The latter contain practical assignments and accompanying educational texts. At Dutch Railways, this has led to great changes in the tasks of developers for these materials. For example, in the old training course for maintenance mechanics, the word "malfunction" hardly appears in the textbook, but in the practice manuals recently developed for the signals department, malfunctions and everyday problems of the workplace are of central concern.

Discussion. With on-the-job training, instruction is led by a trained supervisor or superior co-worker at the worksite. The instructors use training materials and step-by-step training methods. "In general, this planned process involves one on one [sic] workplace learning that utilizes training objectives and plans, active guidance by a trained peer or supervisor, job aids and printed materials, and a systems approach" (Jacobs, 1992, cited in Black, Zenner, & Ezell, 1996, p. 590). On-the-job training has a number of key components. It typically involves some form of instructional materials—either written out in full or as a checklist—that emphasize a step-by-step method. Different programs have different numbers of steps, but they typically include: "1. Prepare the worker, 2. Present the operation (per step and while paying attention to the 'key points'), 3. Try out performance (during which the learner is asked to explain the 'key points') and 4. Follow up" (de Jong, 1996, p. 235). These structured steps are evident in Case 1.

Some argue (Black, Zenner, & Ezell, 1996; Levine, 1997; Rothwell & Kazanas, 1990) that the more you structure the training, the more productive the training program, and the more complete the learning. Conversely, if you don't structure the training, then workers end up being frustrated, and time and efforts are wasted (Rothwell & Kazanas, 1990). Training experts also advocate the creation and maintenance of proper training records (Levine, 1997). As in Case 1, instructors can be trained to encourage trainer buy-in, to teach training and learning styles, and to teach one-on-one training techniques (Levine, 1997). According to Rothwell and Kazanas , supervisors are "the most likely to receive training on principles of structured OJT" (1990, p. 54). Training the trainers is expected to improve the training and therefore the learning.

According to Levine (1997), there should more formality to on-the-job training systems. However, on-the-job training is often haphazard:

> Whether they know it or not, all companies have OJT systems in place. There is always someone standing next to another worker who says the magic OJT words, "let me show you how to do that," and then teaches the other how to run a machine or perform a task. This is called unstructured OJT because it occurs haphazardly—the employee-trainer (a.k.a. expert) teaches the tasks as he or she knows and remembers them. Because of time or other pressures, important steps may be forgotten or simply skipped. As an unstructured system, no criteria are established for the quality of training, nor are records of the training maintained. (Levine, 1997, p. 1)

On-the-job training is typically suited for repetitive tasks (de Jong, 1996) and tasks where it is important to follow consistent processes (Levine, 1997). This may seem like programming workers to be parts of the machine in what Mintzberg calls a "machine bureaucracy" (de Jong, 1996, p. 236). If that is all an organization expects of an employee, then this type of training may be sufficient.

In the example from Dutch Railways (Case 2), the worker is directed to study on his or her own. He or she gets information from books or from people. He or she is more fully involved in his or her own learning activities as a learner than the worker in the case of learning to use a torque wrench. At Dutch Railways learners are not simply provided with instructions; they must seek answers. This is a combination of not only on-the-job training activities, but also self-directed learning activities. Since in the overall program, the primary educator is an instructor, this is categorized as on-the-job training. Many of

the learning activities, however, are self-directed. This approach, as you can imagine, encourages learner initiative and is grounded in adult learning principles.

Some describe on-the-job training simply as people working together (Levine, 1997; Rothwell & Kazanas, 1990). However, because of the lack of a formal "teacher," this type of learning fits into the next category: Participative Learning Activities.

Participative Learning Activities

During participative learning activities, the workgroup community is the primary educator. Learners participate in the work of the workgroup and are guided by more experienced members of the workgroup.

In this section, I examine an apprentice meat cutter (Case 3) whose classroom training is completed and his education now continues at the store (Lave & Wenger, 1991, pp. 78-79). Case 4: Janet Learns a New Job—comes from an article about workplace learning (Rothwell & Kazanas, 1990, p. 53). It is about learning by observing another employee for a period of time. Case 5: A Vai (or Gola) Tailor—is based on a section from Lave and Wenger (1991, pp. 71-72). It is about how "apprentices might engage in a common, structured pattern of learning experiences without being taught, examined, or reduced to mechanical copiers of every-day tailoring tasks, and of how they become, with remarkably few exceptions, skilled and respected master tailors" (p. 30).

Case 3: The meat cutter apprentice. When I arrived at the store I was trained on working the automatic wrapping machine. I learned to handle this competently, but was kept there until another apprentice came. I did this job for years, almost without interruption.

My supermarket meat department manager tries to achieve an advantageous difference between the total volume of sales for the department and the wholesale price of his meat order, plus his cost for personnel and facilities. To do this he sees to it that his skilled journeymen can prepare a large volume of meat efficiently by specializing in short, repetitive tasks. He puts me where he can work me most efficiently. Diverting journeymen from work to training tasks increases the short-run cost of selling meat. Because we are so occupied with profit-making tasks, apprentices like me rarely learn many tasks.

Another problem is the physical layout of our work setting. It is an important dimension of learning, since we get a great deal from observing others and being observed. My department is laid out so that apprentices working at the wrapping machine cannot watch journeymen cut and saw meat. I remember one day when my district manager told me to return poorly arranged trays of meat to the journeymen. I was scared to go in the back room. I felt so out of place there. I hadn't been back there in a long time because I just didn't know what to do when I was there. All those guys knew so much about meat cutting, and I didn't know anything.

Case 4: Janet starts a new job. My name is Janet. I am starting a new job as a clerical employee in a large service firm. After completing the usual paperwork in the personnel department and attending a brief orientation I was introduced to my new supervisor and coworkers.

My supervisor eventually paired me up with an experienced employee for an extended period of participative learning activities [1]. That means I will be observing him for some time before I am ready to do the work myself. In the meantime, I heard that my supervisor complained to others about the time it takes to break in a newcomer.

My learning has not been carefully planned to make me productive as quickly as possible. I have been placed in a new work environment where I must observe unfamiliar tasks and interact with people I do not know. I feel anxious because I am not productive, and I'm thinking about quitting to work for a new organization.

Case 5: A Vai (or Gola) tailor. I am a tailor. I work in one of the tailor shops at the periphery of the commercial district. My shop is amongst the shops of a number of Vai and Gola tailors clustered along a narrow path at the edge of the river. The shop is made of wood; it is dirt-floored and tin-roofed. I make inexpensive ready-to-wear men's trousers for the poorest segment of the population. I've worked here for many years. I began as an apprentice, when my work was exchanged for opportunities to learn.

I learned to sew by hand, to sew with the treadle sewing machine, to press clothes. For each garment, I learned how to cut it out and how to sew it. Some of the first things I learned were attaching buttons and hemming cuffs. Then I learned sewing, the logic (order, orientation) by which different pieces are sewn together. I finally learned to cut.

Like with every operation that I learned, I began by observing one of the journeymen in the shop. While I was observing, I attempted to construct a first

---

[1] I changed this label to be consistent with my definition. Rothwell and Kazanas (1990) used the phrase "on-the-job training" in their description of Janet's learning, but there is little training involved in this scenario.

approximation of the garment. Next came practice, which is carried out in a particular way. I reproduced the cutting process from beginning to end, even though I was more skilled at carrying out some parts of the process than others. Since we learn the production steps in reverse, I had already learned the finishing stages of producing a garment, and learning to sew it. Now I was finally learning to cut. By learning how to sew first, I already knew why garments are cut out as they are. In this way too, I made fewer mistakes and especially less serious mistakes. I started on hats and drawers, informal and intimate garments for children. Then I moved on to more external, formal garments, and ended with the Higher Heights suit.

There were several masters present in my shop doing what masters do—each ran a business, tailored clothes, and supervised apprentices. In addition to the masters, there are journeymen and apprentices. I apprenticed for 5 years, some people take longer and others take less. During that time, I had a rich structure of opportunities to observe masters, journeymen, and other apprentices at work, to observe frequently the full process of producing garments, and of course, the finished products. During this time, experiences of failure were minimized and especially serious failure.

Discussion. With participative learning activities, workers learn from doing the job itself and from observing others doing the job. Expertise is developed through practice, which is why de Jong (1991) called this type of learning activity on-site practice. In these three cases, the learners learn in the work site through doing the job and watching others do the job. The difference between these situations and on-the-job training is the lack of a formal teacher. Direction for learning comes from the work

group, "the sharing of situated and tacit knowledge by the work team members" (de Jong, 1996, p. 239).

Can learning occur without a formal teacher? Those who have studied this question have found that people do learn simply through doing the work itself (Scribner & Sachs, 1991). In a 5-year study of the learning processes of new stockroom workers in an industrial plant, Scribner and Sachs (1990) found that employees learned to use the computer and learned to do regular stockroom tasks without formal training. Senior workers showed the new employees how to do the various tasks in the course of their normal work routines. Employees who learned in this way were as proficient and in some cases more proficient than workers in another factory who were taught in a classroom training program. You have read the case of the tailor who, without a formal teacher, over the course of doing the various tasks, learned "how it all fit together" and eventually became an accomplished tailor (Lave & Wenger, 1991). The educators were the masters and other apprentices. "The instructor role of the supervisor or the experienced colleague should be supplanted with active inquiry by the employee and the sharing of situated and tacit knowledge by the work team members" (de Jong, 1996, p. 239).

One important aspect of participative learning, using Lave and Wenger's (1991) terminology, is "the community of practice" (p. 49). This community can be welcoming, as it seems to be in the case of the tailors, or it can be isolating, as it seems to be for Janet in the office environment and for the meat cutter apprentice at the grocery store. Janet feels anxious and unproductive. She doesn't know the people. A similar reaction comes from the meat cutter in the supermarket who is unable to observe the more experienced workers and not given the opportunity to advance his skills. On the other hand, the tailor

seems to be learning in an environment that is very supportive of his efforts. He had a rich structure of opportunities to observe masters. His learning was very orderly—beginning with simple children's garments, and the pre-steps of buttons and hemming, and working his way toward complex formal garments. This is one of the ways that masters and journeymen ensured that the apprentice's experiences of failure were minimized.

A strength of participative learning involves learning nonroutine tasks like problem solving or dealing with out-of-the-ordinary situations, situations where there is no prescription for what the worker should do in every conceivable situation. Workers learn through trial and error, through observing others, through developing expertise in working through problems.

If companies are autocratic (Washington, 1996), technocentric (Chapin, 1995), or bureaucratic (Marsick, 1986), workers are trained what to do using on-the-job training methods. They are not given the opportunity to develop expertise through participative learning. Workers are simply extensions of the machine and they fill in the gaps that cannot be automated. These companies are not able to make use of the workers' minds and their ability to work collaboratively in problem-solving situations.

On the other hand, businesses with a codetermined learning environment (Washington, 1996), a human-centered focus (Chapin, 1995), or a clarifying learning environment (Marsick, 1986) can allow or encourage employees to develop expertise. In an environment where workers learn through experience and develop expertise, they assist in improving their organizations' products and processes.

Chapin (1995) describes how workers gain expertise from novice to expert and indicates that machine intelligence, much like the intelligence that workers might receive through on-the-job training, is incapable of developing workers beyond the stage of advanced beginner (p. 192). Participative learning, which allows workers to encounter, experience, and resolve problems, assists workers in developing expertise.

If a company is technocentric and organized as a machine bureaucracy, managers will tend to control and workers will not develop expertise. If the organization is human centered, it will facilitate the development of worker expertise (Chapin, 1995).

For participative learning to be effective, according to Knowles (1985), there must be a supportive climate: a climate of mutual trust, collaboration, pleasure, and humanness, where learners are involved in diagnosing their own learning needs and in planning their learning. Likewise, participative learning provides the potential for learners to set learning objectives, design their own learning plans, and evaluate their learning.

As I have argued, there is a case being made in the literature for shifting an organization's focus from training the worker as in on-the-job training, to helping the worker learn as in participative learning (Knowles, 1985; Malcolm, 1992; Sorohan, 1993). Theorists and training managers advocate the importance of making people and materials available to the worker when the worker needs to learn (Knowles, 1985; Malcolm, 1992). In addition, there is discussion of the "100 percent learning event" (Malcolm, 1992, p. 59). Learning is not complete until the learner is able to fluently do the task. If it takes time and practice to do that, learning can only be completed on the

job. During participative learning activities, efforts extend to helping the learner through the entire learning process, not just during the initial training period.

Participative learning activities allow for a 180-degree shift from on-the-job training. They are learning centered, problem centered, and issue centered. With on-the-job training, learners just learn how to do a particular task using a step-by-step method (refer to Case 1: Learning to use a Torque Wrench). With participative learning activities, not only does the worker gain expertise in doing, but also has the opportunity to reflect on and think about the problem itself. Participative learning opens the door to critical reflection (a self-directed learning activity) as described by Marsick (1988) and Mezirow (1981). Whether or not industrial workers as learners use critical reflection and to what extent remains to be seen; the literature concentrates on managerial and professional workers. Critical reflection and critical thinking may be required by all workers in today's highly complex industrial environment.

Finally, "in the modern workplace, work and learning get intertwined" (de Jong, 1996, p. 239). Not only are work and learning intertwined, but they are in tension (Vander Krogt, 1998)—learning goals do not usually coincide with production goals. It may be very difficult to understand participative learning activities without, at the same time, examining the associated on-the-job working activities. As Scribner and Sachs (1990) argue, "Analytically, two activity systems are in progress, but empirically there is only one stream of behavior to observe. Should those behaviors be described as working or as training? How do we know how the participants construe what they are doing?" (p. 5).

Educational Advertising Activities

Management usually sponsors educational advertising. A safety campaign is an example of this type of program. However, unions can also be involved in campaigns, as can government agencies or professional organizations. As such, management or the union becomes the educator. They use media such as posters, signs, or video presentations that are read or observed by the workers during the learning activity.

I developed Case 6 from the section, "Eliminate slogans, exhortations, and targets for the workforce" (pp. 65-66) in Deming's (1986) book, Out of the Crisis. Slogans and exhortations are a form of educational advertising.

Case 6: Four slogans. I am a worker in a manufacturing plant in the Midwestern United States. During my walk from the clock house to my job site, I pass four posters. Each of them is trying to teach me that I should be doing a better job. The first poster shows a man running up stairs with the words "Increase Productivity." The next one, at the washroom, says, "Do it right the first time." It has such a lofty ring. But how could I do it right the first time when my incoming material is off-gauge, off-color, or otherwise defective, or if my machine is not in good order, or the measuring instruments are not trustworthy? This is just another meaningless slogan, a cousin of "zero defects."

Near the cafeteria, there is a sign that says, "Getting Better Together." This slogan makes me furious. Together! What is that, when no one will listen to our problems and suggestions? Another useless poster, a cruel joke: "Be a Quality Worker. Take pride in your work."

What is wrong with these posters and exhortations? They are directed at the wrong people. They arise from management's supposition that production workers could,

by putting their backs into the job, accomplish zero defects, improve quality, improve productivity, and all else that is desirable. The charts and posters take no account of the fact that most of the trouble comes from the system.

Discussion. Educational advertising can make workers aware of shop-floor issues and concerns. The above case highlights the problem of educational advertising activities in isolation. Perhaps educational advertising does have a role to play on the shop floor if it is used in concert with other shop-floor learning activities. An example of educational advertising in the classrooms is the use of posters to promote reading. The posters are more effective if the classroom teacher also encourages reading. A poster that says, "Do it right the first time," as in the example from Case 6, might be more effective if trainers, and supervisors and coworkers support the learner in doing it right the first time. Another example is related to safety. Most shops have safety posters, but they also have safety programs that are tied to the ideas in the posters.

Incidental Learning Activities

During incidental learning activities, experience itself is the educator. During the experience, the learner is involved in another activity when something catches his or her attention. That something becomes the educator. For Isaac Newton it was an apple that fell while he was resting under an apple tree. During incidental learning, learners can learn from apples or rocks and these objects therefore become our educators. Incidental learning activities can involve people too, but here people are not deliberately showing the learner something, or the learner is not deliberately watching other workers do

something. The person shows you by surprise and the learning activity is incidental to whatever learners are doing.

The following case is from a situation described by Versnel, Hutchinson, Munby, and Chin (2002) about Laurie, a co-op student learning in a garage. This case is about how Laurie might have acquired the skill of "choosing sockets."

Case 7: Choosing sockets. My name is Laurie, I am a co-op student who works in an independent, neighbourhood garage managed by Brenda. We do oil changes, tire repairs, tire installation, brakes, front-end work, engines, everything bumper-to-bumper on a car. I work with two class A's [mechanics], two apprentices, and a tire installation guy. Two tool chests are located at the back of Bay 1, one at the back of Bay 2, and one where Bays 2 and 3 meet. On a busy day, tools are not always returned to the tool chests at the end of each job. The mechanics always seem to know what jobs everyone is working on and where particular tools are located and will call to one another about the tools.

One day I was trying to do an axle. I was looking for a socket, but I couldn't find the right one. I wasn't sure which one I was after. I got one, walked back and it's not right, I walk back and get another one and walk back. I grew increasingly frustrated.

Then, while I was at the toolbox returning a socket, one of the other mechanics was at the toolbox at the same time. (Whenever they go to the tool chest, they seem to easily find the right tool. They open a drawer, remove a tool, and return to their vehicle within a few seconds.) This time I noticed that he took two sockets from the chest. The sockets were about the same size. He was working in the bay next to mine so I saw that he tried the first socket, and it didn't fit, so then he tried the other. It fit! That's not

complicated! I then realized that he doesn't always know which tool he needs. He tries several sockets until he finds the one that fits.

Discussion. During incidental learning, the learner is involved in an incidental activity when unexpectedly an experience of some sort educates. Even though the experience can involve another person as in Laurie's case above, the activity is not really participative learning. Ross-Gordon and Dowling provide the following definition of incidental learning:

> Incidental learning is defined as spontaneous action or transaction, the intention of which is task accomplishment, but which serendipitously increases particular knowledge, skills, or understanding. Incidental learning then, includes such things as learning from mistakes, learning by doing, learning through networking, learning from a series of interpersonal experiments. (cited in Lankard, 1995, p. 1)

Laurie in Case 7, through a chance observation of one of the mechanics, discovered that she didn't have to pick the "right" tool. This learning was incidental to the work. The case illustrates how incidental learning episodes "provide us with learning opportunities (usually unintended) which we may seize on or pass over as we feel so inclined" (Rogers, 1996, p. 36). Incidental learning involves the first stage of Buckler's (1996) learning process—ignorance. "No one knows what they don't know, so no blame can be attached to individuals who find themselves in a state of ignorance. Indeed, this stage is, or was, the starting point for everyone" (p. 34). When people move to Buckler's second stage, which he calls "awareness," they may choose to "seize on" the opportunity or "pass it over."

Laurie learned of the error involved in thinking she had to pick the "right" tool. Ackoff (1996) argues that

> we do not learn something by doing it correctly; in such a case we already know how to do it. The most we get from doing something right is confirmation of what we already know. We can acquire knowledge, however, from doing something incorrectly but only if we determine the cause of the error and correct it. (p. 29)

Argyris (1994) defines learning "as the detection and correction of any kind of error" (p. 36). Incidental learning activities often involve the detection of errors.

Incidental learning events can also achieve the opposite intent of learning; they can lead to error. "Incidental learning is not a conscious process notes Watkins, and in the course of incidental learning, we can embed wrongful ideas about the organization that can block learning" (Watkins, in Sorohan, 1993, p. 47).

When workers consciously intend to learn and correct the "error," perhaps as a result of an incidental learning activity, it leads to the final type of learning activity: a self-directed learning activity.

Self-Directed Learning Activities

During self-directed learning activities, the learner is both learning and facilitating his or her learning. The learner is self-actualized and constructs knowledge through his or her own efforts.

With self-directed learning activities, the learner is the educator. This situation is furthest removed from on-the-job training. Although self-directed learning is a theoretical category, does it occur in industry? I developed the following case from Clardy (2000, p.

114). Clardy explained why the learner initiated "a vocationally-oriented self-directed learning project." I have supplemented Clardy's example with a description of one way that the learner may have proceeded with his learning plan.

Case 8: A driver-mechanic at Agri Products. My name is John Hunter, I am a 22-year-old driver-mechanic with Agri Products. I am responsible for maintaining the commercial vehicles used by Agri Products.

State regulations require commercial vehicles such as those used by Agri Products —which I am responsible for maintaining—to be inspected regularly. During a regular inspection, I found a problem with the brake system in a vehicle. Having never done brake repair work before, I began learning how.

I had a number of vehicle repair manuals available to me. I first checked them to see if they might be helpful. The manuals contained diagrams and instructions that were somewhat helpful, but after I had taken a rear brake apart, for the life of me, I couldn't figure out how to get it back together. I hopped in my car and took the parts to a brake shop where a buddy of mine works. I asked if he would mind helping me put the thing back together. I explained that Agri Products had agreed to pay the bill, plus any additional time that resulted from helping me. He showed me all of the steps, including a trick to get the spring back on. I would have never figured it out myself, but now that I've been shown, it's easy and I can now do all of the necessary brake work myself.

Discussion. Clardy (2000) found in a study involving 109 learning projects, by 56 workers from 6 participating organizations, that 90 were vocationally oriented self-directed learning projects. Without motivation and curiosity, there would be no self-directed learning. McGraw and Forrant (1992) indicate that 43.8% of workers have taken

an upgrading course since getting into the trade and 92% would like to further advance their skills. Worker-driven learning does occur frequently. Scribner and Sachs (1991) found that some stockroom employees attended computer classes at their own cost and on their own time. Like with John in the previous case, self-directed learning can also involve activities directed mainly by the learner, activities where the learner takes steps to learn how to do something on his or her own or learn how to improve an existing process. According to Tough (1979), "people can be active, energetic, free and aware. They often choose their goals, direction, and behavior and are not always pushed by the environment and by unconscious inner forces" (p. 6). There can be learning, even in the absence of training. Tough indicates that people desire to perform above the bare minimum. Organizations obviously want workers who do more than just what is required. Training emphasizes doing the bare minimum and can even discourage going beyond the standardized process. Learners seek to do more.

Summary of Learning Typology

In on-the-job training, an instructor is the primary educator. With participative learning, either through design or the nature of the organization, learners enter as newcomers and can become full members of the community by participating with the workgroup community. With educational advertising, management or unions educate through slogans and posters. With incidental learning, experience is the teacher. Finally with self-directed learning, the learner directs the learning activities.

There is overlap among the categories in this educational typology. The learner may be very self-directed within an on-the-job training program or during participative

learning. In addition to overlap, the different types of learning may occur in sequence. First a worker might be told what to do through on-the-job training. Then the worker may develop expertise through participative learning, and continue to develop beyond the expectations of the organization through self-directed learning.

Although educational researchers describe learning in different ways, few have documented how workers describe their shop-floor learning. That is the focus for this study. In the next chapters, I describe the approach that I adopted to investigate how industrial workers describe their learning activities. I label the different types of activities that the industrial workers describe. I compare their best case examples of learning to their worst case examples. Through these efforts, I hope to describe and discuss how six workers and I describe learning activities on the shop floor.

CHAPTER THREE: METHODOLOGY AND PROCEDURES

Introduction

This study's purpose is to document and understand how six workers in an industrial setting and a researcher describe shop-floor learning activities. I collected the data through semistructured interviews (Merriam, 1998) with six toolsetters who operate and troubleshoot the most complicated machining lines in their manufacturing plant. Their stories are analyzed for themes and patterns (Ertmer, 1997) that describe the workers' learning activities. In addition, I describe and discuss my learning activities in two reflective chapters.

The data are analyzed in three ways. First, the typology of shop-floor activities developed in chapter 2 is used to examine the nature of the workers' learning activities. Second, common themes are identified from the interviews and these are discussed in light of what was found in the literature review. Third, best- and worst-case examples are analyzed individually and compared with those of the other participants to determine the important positive and negative aspects that the workers identify in their learning activities.

Based on these analyses, I then reconstruct the workers' stories and present a narrative on how these workers describe learning activities. This narrative is structured around the key themes and consists of direct quotes from the workers.

I use a narrative approach to examine my own understanding of learning activities as you read earlier in "Learning Engels." I will do this again when I tell the story of my understanding of learning activities as it relates to writing the proposal for this thesis.

This self-narrative will be the basis of Researcher Reflections II, which follows chapter 4. All of these narratives form a narrative inquiry about learning activities, specifically a narrative about learning activities as six workers and I describe them in our industrial and educational settings.

Narrative Inquiry

"Narrative is now seen as one of the fundamental ways in which humans organize their understanding of the world" (Cortazzi, 2001, p. 384). Cortazzi states four reasons for doing narrative analysis. First, narratives share the meaning of experience. In this study, the narratives demonstrate the understandings, or meanings, of learning for me and the six workers. Second, narratives enable the representation of peoples' voices, "so that others may know life as [we] know it" (p. 386). In this study, you have already begun to know aspects of my life as I know it and the lives of various people in the literature review. In the findings, you will meet six workers and get to know life as they know it. Third, narrative reveals personal qualities: "the insider's view of what a job is 'really' like" (p. 386). Cortazzi describes a supermarket example where the narrative reveals the store manager's panic, persistence, and frustration. In this study I reveal these human qualities in my stories, the stories from the literature, and as you will read in the findings, the stories from the six industrial workers. Finally, Cortazzi sees narrative research "itself as a story ... using story conventions to persuade readers effectively" (p. 387). The findings chapter is formatted as reader's theater, which is a staged dramatic presentation of people's narratives (Adams et al., 1998; Donmoyer & Yennie-Donmoyer, 1998).

Why Narrative Inquiry?

This study inquires into how these workers and I describe learning activities in our setting. It is about our experience unreduced, our experience as a story. "Keeping this sense of the experiential whole is part of the study of narrative" (Clandinin & Connelly, 1991, p. 261).

Scholars increasingly want readers to experience a sense of empathy for the lives of the people being studied (Eisner, 1997). According to Eisner, "human feeling does not pollute understanding" (p. 8) and, in some situations, empathy is necessary for understanding. If you are an educator of any sort, I want you to empathize with these workers.

This study documents how a researcher and six workers describe their own learning activities. The purpose of this study is to bring you, the reader, into this phenomenon. Narrative inquiry is "less a matter of the application of a scholarly technique to understanding a phenomenon than it is a matter of 'entering into' the phenomena and partaking of them" (Clandinin & Connelly, 1991, p. 260). In Narrative Inquiry, Clandinin and Connelly (2000) tell the readers that "our intention is to come to the 'definition' of narrative inquiry slowly in this volume by 'showing' rather than 'telling' what narrative inquirers do" (p. 20). Showing is important not only to narrative inquiry; as you will read later, showing is also an important learning activity. Showing is also an important part of this research. In chapter 4, I will show you the six workers rather than just telling you about them. In this chapter, I will show you how I analyzed the data from my pilot study using more traditional qualitative methods so that you can sense the difference when I present my findings in chapter 4.

We experience the world not only through story, but also as story. "In school, as in life generally, one's personal history, the traditions of which one has a part, and the social and community relations in which one engages form the plot outlines of day-to-day life" (Clandinin & Connelly, 1991, p. 259). A purpose of this study is to draw educators into this narrative so that I and these workers can influence the way educators live out their educational stories.

The Researcher Inside the Narrative

The researcher makes a difference to the narrative. The researcher can be an insider or an outsider (Acker, 2000). The researcher has research intentions, voice, and signature (Clandinin & Connelly, 1994).

I am an insider, not only in this study's industrial setting, but also in my educational setting. By virtue of my location, I have access to these workers in their setting. In a study of the Toyota Camry Plant, Besser (1996) was an outsider and only had access to Toyota employees who were neighbors, relatives of fellow students, members of his church, friends of friends, and others he knew. In contrast, as a fellow employee, I was able to connect with workers directly and in the work setting. By virtue of my knowledge and experience, I was also able to understand the aspects of the workplace more easily than an outsider could (Acker, 2000). I understand the business. Being an insider is helpful, but it is potentially hindering as well. During interviews, shared understandings were not always spelled out (Acker, 2000). This is another reason for narrators to fill in these unspoken gaps. Although I was an insider in some ways, I was an outsider in others. I am a researcher, a manager, I don't do the same jobs as these workers, and so I do not totally have an insider's view.

My intention also influences the story. I am interested in shop-floor learning. The workers knew this when they were being interviewed. My questions focused on this type of learning. But as you will see in chapter 4, classroom training also was mentioned during a number of the interviews. My typology didn't delve into this workplace learning activity, not because it isn't important, but because it isn't a central focus of this study. Readers who are unaware of my intention may misinterpret my findings.

For all of the above reasons, you will hear my voice throughout this document. My voice is important so that you can understand my intentions, so that I can explain things that were "not spelled out" in the interviews, and so that you can understand my own story about shop-floor learning and how it influences my telling of the six workers' stories. One of the starting points of narrative research is the researcher's own narrative of experience (Clandinin & Connelly, 1994). In "Learning Engels," I told you a story about me. I will do it again in "Learning to Write." The rest of this document is also my story. In the literature review, I told you about my understanding of the literature. In the next chapter, I will tell you my story about what I learned from the six workers. My story is based on the workers' stories, but it is still my story.

The Acceptance of Narrative Inquiry as a Research Methodology

"Storytelling...is becoming more disciplined in a line of work called narrative inquiry" (Stake, 2000, p. 441). An entire chapter, "Autoethnography, Personal Narrative, Reflexivity," (Ellis & Bochner, 2000) in The Handbook of Qualitative Research (2nd ed.) is written as story. This handbook also has a chapter "Writing: A Method of Inquiry" (Richardson, 2000). The first edition of the The Handbook of Qualitative Research had a chapter, "Personal Experience Methods" (Clandinin & Connelly, 1994) devoted to

narrative methods. Narrative inquiry is becoming more accepted. In order for me to answer my question, "How do these six workers describe learning activities?", I need to turn to narrative inquiry.

Selection of Participants

For a number of reasons, I picked six toolsetters who work on the plant's most complicated machining lines for this study. First, I wanted people who do similar work. Second, I wanted people who have been engaged in a lot of learning—people with stories. Third, I wanted the learning activities to have taken a long time. As an educator in industry, I'm interested in improving the learning curve—helping people learn faster and more effectively, if possible. These machines also tend to be the plant's bottlenecks —improved throughput here results in improved throughput for the entire plant. Fourth, by selecting specific operations, the selection of specific operators could be randomized somewhat. I approached the individuals who happened to be on-shift rather than seeking out specific individuals. Fifth, by using equipment in different areas of the plant I was able to get more volunteers than by focusing on one particular piece of equipment and the smaller number of toolsetters who run that machine. I ensured that at least one of the participants was a woman. (About 10% of this plant's production workers are female.)

Interview Guide

Here is the guide that I used during the semistructured interviews. The workers were each given the guide before they decided to participate. I wanted them to know in

advance what we would be talking about, to avoid putting them into uncomfortable situations. I also wanted the interviews to be as free flowing as possible. I used the guide as a check to ensure that the various topics were covered. This seemed to work, since none of the interviews ended up as a simple question and answer period. The language of my questions and prompts may have informed their descriptions, but since they all had years of experience on the shop floor, I don't believe that any of them were unduly swayed by the words that I used. As with any conversation, my contributions influenced what they reported. But I can only take the workers at their word and assume that what they said is what they meant. They received copies of my findings, had opportunities to clarify their words, and could have withdrawn from the study at any time.

The Guide

I am interested in learning how to help people learn on the job, through ongoing experience. Learning on the job is different from learning in a classroom. It happens while you're doing the work.

1. Please name some of the things you have learned to do on the job.
2. Which of these would you say is the best example of on-the-job learning?
3. Describe what you learned. What are the tasks/skills/results that you now know how to do/achieve?
4. Describe what happened while you were learning. Begin by telling me why you wanted to learn and how motivated you were. (Was it your choice?) Then describe the different things you did in order to learn. Finally, tell me when and how you decided that you were finished learning this task/skill.

5. Think of some of the other people involved. What did they do to help or hinder your learning? What were they like to work with?
6. Describe the written materials that were provided or created during your learning.
7. What aspects of the learning caused you the most trouble or concern?
8. Do you have any suggestions that could have improved the situation?
9. Now pick the worst example of on-the-job learning from the list (in Question 1).

   I will repeat the list of questions. (Repeat Questions 3-8)
10. I'm interested in on-the-job learning. Are there any questions that you would ask about on-the-job learning if you were in my place?

Thank you for your participation.

Procedures

After letting management know what I was doing, I personally approached the toolsetters. I explained the study, gave them my question sheet, and asked them if they were interested in being interviewed. If they were, I indicated that I'd be back when it was convenient for them. The interviews were conducted in a quiet, private area during their shift, when their machines were running smoothly. This afforded privacy and avoided interruptions. There was one interview for each participant and each interview lasted about an hour.

Data Collection and Recording

Interviews were taped and then transcribed. The copies of transcribed interviews were offered to the interviewees for review and comment. One of them called me and expressed interest in reading the final thesis. He and four of the others were supportive of the Findings chapter when I approached them. The sixth toolsetter, originally did not want a copy of her interview transcript or the findings. When approached later, this toolsetter seemed interested in reading the findings, but has not responded since that encounter.

Data Processing and Analysis

Transcribed documents were entered into Q.S.R. NUD*IST, a qualitative researcher's computer toolkit (Gahan & Hannibal, 1998). I explored the data using *a priori* (Constas, 1992) categories to find *in vivo* subcategories. A priori categories are those chosen in advance. In vivo categories are ones that come out of the data. The NUD*IST computer program made it extremely easy to categorize and explore the data in a number of different ways beginning with different a priori categories. For example, I began by categorizing the data according to the learning typology that I developed for chapter 2. I also characterized the data according to technical, psychological, and social aspects because I initially thought these categories would be a useful way to describe learning activities on the shop floor. In addition, I coded the data with the a priori codes of "helpful" and "troublesome" aspects, by the answers to the interview questions, and by each of the worker's best- and worst-case examples of learning situations.

Within these a priori categories, I then looked for in vivo categories that reflected the workers' language in the narratives. An example of an in vivo category is "being shown." As you will see in the findings, "being shown" is a very important part of learning activities for these workers.

Constas (1992) describes three components to categorization: (a) origination, (b) verification, and (c) nomination. Category origination, as I described earlier, involved categorizing according to a priori categories such as those arising from the typology of learning activities, and technical, psychological, and social aspects. Categories also originated in vivo from the workers' stories, for example, the category "being shown." Category verification, that is, do these categories make sense, was examined rationally—do they make sense logically, and using a participative approach—do they make sense to the participants? The names of the subcategories (nomination) use the participants' words, not mine. The example used earlier, "being shown" is in their words.

The NUD*IST program made it easy to identify and gather workers' descriptions within various categories. Exploring the data from multiple points of view made it easy to get to know each of these workers' stories. I discovered several themes that were common to all of the workers' stories. Being able to find and extract pertinent quotations made this program invaluable in sifting and sorting the fragments of their stories into the narrative that you'll find in chapter 4.

NUD*IST had weaknesses as well. It is so easy to categorize and recategorize that one can get lost and miss the workers' stories altogether. The stories are based on the categories, but to see the stories, I had to take a step back from the categories. This became clear when I analyzed a first pilot interview.

Pilot Study—Roger Learns to Lift

Before interviewing the six workers, I did a pilot study to test my research methods. I interviewed someone I knew, because I wanted to get honest answers to two additional questions. What did he think of the questions that I asked? What amount of time could I reasonably expect to spend interviewing workers?

I interviewed, out of convenience, a skilled tradesperson in order to pilot test my interviews. The semistructured interview (see Appendix A) was helpful in accessing this person's stories about shop-floor learning activities. Among other stories, Roger[1] talked about hoisting and removing unique pieces of machines in order for them to be repaired in the machine shop. These lifts are difficult due to the unpredictable weight distribution of these heavy parts (4,000 pounds) and the tight quarters from which they have to be removed.

I used QSR NUD*IST to analyze the results based on the categories of my shop-floor typology of learning activities. What follows is the result of that analysis in narrative format.

Roger's Learning Activities

Roger's story included examples of several types of learning from the typology of learning activities in chapter 2. He described participative learning, incidental learning, and self-directed learning. He didn't mention personal involvement in on-the-job training. He also made no mention of educational advertising.

---

[1] All proper names are pseudonyms

Roger was once an apprentice, an apprentice who was involved in classroom training and on-the-job training. One of his learning problems after graduating from the apprenticeship was thinking that "I should know it all now." This caused him some stress. What an unfortunate unintended consequence of separating learning from doing. Is this what happens when we separate learning from doing and "think we have to know it all"?

> In an apprenticeship, you think of yourself as in a learning program. When you finish the apprenticeship, you think that you have to know it all. And deep down inside you know you don't.

He has some thoughts regarding on-the-job training and "foolproof methods," mostly in reference to the nature of work on production lines, not so much to his own job.

> Programmable machines. Foolproof methods for assembling things—you have to go in the right sequence. You're almost forced to do it. Some people are wired to do things different a lot. Variety. With a lot of these new machines you're forced.
>
> It's like when I go into a Subshop I tell the girl that I want tomatoes and lettuce, she says, "hang on, do you want olives?" I say, "no, I want tomatoes."
>
> "Yes, but do you want olives?"
>
> She won't deviate from what she's been trained to ask me. It's wired in her. She's like a robot. I recognize that and I'll do that every time. She's been trained to ask this, this, this. Not start at the other end. She's been ISOed [referring to the standardization required by the International Standards Organization] to death.

One of Roger's main learning activities is participative learning. A co-worker, rather than a teacher is directing Roger's learning. Prior to beginning this study, I never imagined the extent of participative learning activities on the shop floor. Here is Roger talking about "taking the first bolt off and going from there" and "help calls."

> Probably the most helpful thing a millwright ever said to me was, "Take the first bolt off and go from there." Start the job.
>
> **That sounds pretty informal.**[2]
>
> Yes. Try to build your confidence over time.

---

[2] Researcher's dialogue is boldface.

> When you verbally express your anxieties about not knowing all the jobs in a particular area. And when you, maybe more than usual ask people for help, so you put in a "help call." No one gives you any grief when you put in a millwright call for help. It's based on the fact that you need someone else to explain to you how to do the job.
>
> **That's a common occurence? You even describe it as a help call.**
>
> You can do it whenever you want. No one will argue with you when you put in a call for help.

Even when he is not intentionally learning, experience itself is helping him learn, Roger continues to be involved in incidental learning activities.

> They [older tradesmen] helped by showing you that time in, time out, they were learning the job too. They wouldn't act like, "I've done this job a million times—this is easy!"
>
> **So it was how they acted—you observed them.**
>
> Yeah. Some people will always come across like they know it all. But by and large, the better millwrights and the older and more relaxed ones they just realize that you're not going to remember it all. And so you have to learn to get out there with an attitude of, "Let's just go at it." Try things until it lifts up flat.
>
> And talking about getting that first bolt off, often you're working with a tradesman who didn't have the confidence to take that bolt off, and yet had the experience. So you know that people have different levels of confidence. Sometimes they're up, sometimes they're not. It depends on how everything in your life is going. Some people have weak spells where they just don't have the confidence to do their job.

Finally, here is an example of a self-directed learning activity. Over the course of several years, Roger felt that he reached a "comfort level."

> Well, you have to do jobs like that; they come across the computer all of the time. There are jobs where you have to make a lift that you've never done before. So you have to find a comfort level in hooking up to this piece of machinery that you've never lifted before and get it to come up —be it level or straight up, and try to do it within two or three tries. Often that's what you do. You move the slings around until you get it just at that right amount of levelness to pull it out. And then you put it on a handcart or … And without damaging it at the same time.
>
> This particular one might have been 4,000 pounds. After you've done those tougher lifts that are challenging and done them with again, hooking and trying this and trying that and finally getting it, you get to a comfort level after two or three years of coming across that lift every, let's say, six or seven months.
>
> Again, you go do the job and you bring your slings and whatever else you need—shackles and eyebolts and hookup in different places, and you get good at just trying something—anything. Some people sit and plan forever and after eight hours you won't have lifted it up. Eventually someone has got to decide to try something, and then from there if that doesn't work, rearrange the different slings until you do pick it up.

Roger's learning activities include many of the elements of the typology of learning activities. In particular, he describes learning activities that involve three principal educators—fellow workers, experience, and Roger himself.

From the pilot study I determined that shop-floor learning is multifaceted and that my learning typology assists in identifying different types of shop-floor learning activities. In addition, I found that the unstructured interview achieved its goal of helping Roger to describe his shop-floor learning. Finally, I determined that 1-hour interviews would be suitable.

Data Presentation—Reader's Theater

"The crucial problem of what we so cavalierly call 'writing it up' is to balance, harmonize, mediate, or otherwise negotiate a tale of two cultures (the fieldworkers' and the others)" (Van Maanen, 1988, p. 138). I have chosen reader's theater as my way of addressing these issues.

According to Donmoyer and Yennie-Donmoyer (1998), reader's theatre minimizes realism in order to engage the reader, it gives us human beings in three dimensions, and "generates space which invites the audience or readers to construct their own meanings" (pars. 27, 31). The findings of my pilot study are not in reader's theater format—I spoke for Roger or quoted from Roger and then interpreted the quotes. I will use reader's theatre to present the findings of this study. You will see that the six workers almost speak for themselves. Remember though that I chose what was to go into the

script and the order in which it is presented. However, reader's theatre still leaves participants' stories intact.

Assumptions

I assume that I have a reasonable sampling of toolsetters for this study. I assume that there are similarities in the nature of their jobs, the nature of their learning activities, and their natures as human beings. I assume that they will largely reveal their story without altering it because they "don't want to come across as being negative" or sounding too much "like one of management's favorites." As you aware, I am an insider at ACME Marine. I've been privy to workers' talk for years, and I feel confident that these stories reveal the workers' perceptions. I assume as well that reader's theatre allows me to accurately present and reflect the workers' views. I also assume that shop-floor learning is an important field of study for industry and academia and that this field will benefit from understanding the perceptions and perspectives of these learners.

Limitations

I only have so much time. The six 1-hour interviews capture only the broad strokes of the toolsetters' world. Interviews capture what the toolsetters describe in response to the questions I ask—they do not document the experience as it occurs.

I am not a toolsetter. Ideally, this study could be undertaken by a toolsetter furthering his or her education and perhaps interested in adult education. I know of a toolsetter with a teaching certificate, who works with some of these workers. He would be on a more equal footing with the toolsetters than I am. His language would more

closely match theirs. There would be no differences in power. Even though I took steps to ensure that workers did not feel pressured to participate, they may have felt some pressure—I can't know this. Even if I asked, they might not tell me. With someone of similar power they would have a greater power to refuse if they were so inclined. I diminished any coercion by approaching the workers alone, without their supervisor. I let them know that participating in the study was up to them, and that I didn't need an answer right away. I explained that they were free to participate or not participate, that I would simply keep asking other people in other areas until I found someone who was interested in being involved. Several of them did tell me that they felt that they had nothing to contribute, or that I might not want to hear about their negative experiences. In these situations I told them that I was after their shop-floor stories, good and bad. I told them that I was especially interested in talking to them because they had important stories to tell. (Roughly speaking, 50 percent of the people I approached agreed to participate.)

Establishing Credibility

In this study, I seek to determine how six workers and I describe learning activities.

Internal validity is important because it addresses questions about how this research matches reality. I conducted conversational interviews and reported the conversations in reader's theatre. I believe that what the workers say about their learning activities during the conversation describes their learning activities.

Reliability is also important because it addresses questions about whether this study's findings can be replicated. I coded and categorized my data a number of ways,

but the same themes always seemed to emerge. I must have coded the transcripts consistently—at the very least I was being repeatable.

External validity addresses questions about whether this study's findings can be applied to other situations, and is therefore important as well. This study contains narratives from the literature, narratives from six workers, and narratives from me. Since these narratives contain common threads, the study contains a reasonable amount of external validity.

Merriam (1998) suggests six basic strategies to enhance internal validity: (a) triangulation, (b) member checks, (c) long-term observation, (d) peer examination, (e) participatory modes of research, and (f) clarifying researcher biases. Triangulation enhances validity by checking for consistency from different points of view. I make connections between the chapter 2 literature review and its eight case studies with the stories from the six workers and me. I member-checked my results with the participants and cross-checked them with my own experience. I have worked in this organization for over 25 years so my findings should also be grounded in long-term observation. My thesis committee provides a form of peer examination to ensure that this study makes sense to them. Qualitative research is naturally a participative mode of research. I have discussed my findings with Roger and the six toolsetters. Regarding the clarification of my research biases, these should be evident in my reflective chapters.

Regarding reliability, other researchers should be able to conduct similar research based on the descriptions contained in this document. I would not expect them to present identical analyses, but to uncover similar descriptions of learning activities.

Merriam (1998) has this to say about external validity:

> The general lies in the particular; that is, what we learn in a particular situation we can transfer or generalize to similar situations subsequently encountered. This is in fact how most people cope with everyday life. I get one speeding ticket from a trooper pulling out from a concrete buttress; subsequently, I slow down whenever I come upon concrete buttresses on any road. (p. 210)

I find that learning activities have multiple threads from the typology of learning activities. This is evident in the learning activities described by the six workers, by the cases from the literature, and in my descriptions of my learning activities. It is safe to say that this concept is at least somewhat generalizeable.

Finally, you the reader, as you make sense of your own learning, in your field of endeavor, you will be another check on this study's credibility. If this study doesn't make sense to you, it won't have achieved its purpose of helping you to understand shop-floor learning activities from the workers' perspectives.

This study is a narrative study. I retell stories. I heard stories and interpreted them (Riessman, 1993). According to Riessman, this is not just a "problem" with narrative inquiry. He says this is a problem whenever we "let symbols stand for, or take the place of the primary experience...all forms of representation of experience are limited" (p. 15). Clandinin and Connelly (1994) have this to say about the tentativeness and practicality of narratives:

> A narrative is always tentative to a degree....Furthermore, a narrative is both inescapably practical and theoretical. Practitioners and researchers commit themselves to reflection and deliberation in the construction of stories and narratives. A narrative construction is practical because it is concerned with a

> person's experience in time, and it is uncertain because the stories that are told and retold could be otherwise, as indeed can the narrative threads and the intentional futures to which they attach. (pp. 263-264)

Here is what the Personal Narratives Group (cited in Riesman, 1993) said.

> When talking about their lives, people lie sometimes, forget a lot, exaggerate, become confused, and get things wrong. Yet they *are* [original italics] revealing truths. These truths don't reveal the past "as it actually was" aspiring to a standard of objectivity. They give us instead the truth of our experiences....Unlike the Truth of the scientific ideal, the truth of personal narratives are neither open to proof nor self-evident. We come to understand them only through interpretation, paying careful attention to the contexts that shape their creation and to the world views that inform them. Sometimes the truths we see in personal narratives jar us from our complacent security as interpreters "outside" the story and make us aware that our own place in the world plays a part in our interpretation and shapes the meanings we derive from them. (p. 22)

I hope that once educators have read my narrative, I will have brought them into this story. I want educators to better appreciate shop-floor learners' stories so that these educators will be able to identify and cooperate with the other educators present in a learner's learning story. Trainers, coworkers, experience, management, unions, and the learner all shape shop-floor learning activities for shop-floor learners. None of them have to go it alone.

Ethical Considerations

A key ethical consideration is ensuring that the participants come to no harm through either participating or not participating in research. As a result, I approached individuals directly, rather than through their supervisor. I also removed all references to their machines, processes, and part names and replaced them with machines, processes, and part names for a similar but fictitious "ACME Marine." I refer to the toolsetters in this fictitious plant by the code names that they chose.

I am the Assistant Administrator of Organizational Development in the Human Resources Department. The participants are workers from various areas of the plant. I am in no position of power over these workers. They were free to participate in or withdraw from the study at any time.

This study has received approval from the Brock Research Ethics Board (file 01-001). A copy of the approval form is in Appendix B.

Summary

How do workers in an industrial setting describe learning activities? How do I describe them in my qualitative research setting? In this study, I examine a particular set of workers, workers in whom I happen to be interested. In the study I also reflect on my own learning—something in which I am also interested. Hopefully, through this study, I am able to provide you with some understanding of how these workers describe their learning and insight into the way that I as a novice researcher have come to a new understanding of my own learning.

CHAPTER FOUR: FINDINGS

I interviewed six workers about their shop-floor learning activities. I read and analyzed the transcripts of these interviews over and over again—searching for the clues that would help me to understand their learning activities. I was looking for an ideal mix of factors. I thought these factors were categorized into three main areas—technical, psychological, and social. When I took this approach with six workers, there was so much information and so many ways to dissect it. (A problem exacerbated by the ease with which NUD*IST enables researchers to create categories.) I had two problems. The first involved teasing discussion about learning out of conversations that talked about both learning and working. The second involved documenting the analytical complexity of their learning.

Discussion about work and learning overlapped. This was not surprising. I was witnessing that "analytically, two activity systems are in progress, but empirically there is only one stream of behavior to observe" (Scribner & Sachs, 1990, p. 5). I sorted this out somewhat by finding best- and worst-case examples of learning in each of the interviews and sorted out dialogue that did not relate to these situations directly. NUD*IST was a great help with this[1].

I coded text at the paragraph level. I went through each interview and looked for examples of a category. Paragraphs could have multiple codes. I went through the data a

---

[1] I caution readers who are considering the use of computerized analysis tools like NUD*IST. It would have been better for me to use a simpler program. I recommend using the simplest tool that will do the job. A simpler computer program, like a smaller dog, would have been less able to pull me off track, as NUD*IST—the larger dog—tended to do.

number of times. I looked for technical, psychological (personal), and social aspects. I looked for elements of the typology of learning activities. I searched for descriptions of learning activities. I looked for helpful and hindering aspects. In most cases, once the broad coding was done, I created sub-codes for each category (as I explain below). In general, I followed Merriam's (1998) approach.

> Consider the task of sorting two hundred food items found in a grocery store. These two hundred food items in a research study would be bits of information or units of data upon which to base an analysis. By comparing one item with another, the two hundred items could be classified in any number of categories. Starting with a box of cereal, for example, you could ask whether the next item, an orange, is like the first. Obviously not. There are now two piles into which the next item may or may not be placed. By this process you can sort all of the items into categories of your choice. One scheme may separate the items into categories of fresh, frozen, canned, or packaged goods. Or you could divide them by color, weight, or price. More likely, you would divide them into common grocery store categories: meat, dairy, produce, canned goods, and so on. These categories would be fairly comprehensive classes each of which could be further subdivided. Produce, for example, includes the subcategories of fruits and vegetables. Fruits include citrus and noncitrus, domestic and exotic. All these themes emerge logically from the "data"—the food items. The names of the categories and the scheme you use to sort the data will reflect the focus of your study. (p. 180)

Because I sought to find answers in the details, for every category that I created I explored deeper and created new sub categories. As a result, the analysis resulted in many

categories. In the technical category for example, I had 10 subcategories: methods, my (the worker's) knowledge, other's knowledge, manuals and instructions, records, measures, my attributes, tasks, learning, and system attributes. Within methods alone, there were an additional 23 categories: thought processes, learning by watching, just told, putting on bandaids, trying things haphazardly, being trained, step by step, travelling, word of mouth, orientation, watch and repeat, show and tell, follow and observe, here you go just do it, on-the-job training, trial and error, repeating over and over, process of elimination, trying to learn on your own, just guessing, picking things up as you go along, classroom after experience, and classroom training. My problem was reporting this in an understandable way.

There were major themes, however. Themes that emerged no matter how the data were analyzed. These major themes included:

Being shown.

Learning the hard way.

Getting comfortable at it.

The category of *being shown* had the subcategories of who, what, why, how, when, show and tell, and shown by a non-biased person. Under *how*, there were categories of properly, physically, being shown and taking notes, being shown different ways, being shown exactly, being shown and taking time. I didn't know how to report this one topic, how workers are shown, let alone all the others.

I was stuck.

So I tried something different. I used narrative to report the findings as a whole, instead of reporting each of the individual details.

I was interested in the forest, but I was describing individual trees. I was analyzing, when I should have been synthesizing (Ackoff & Johnson, 1997). I was telling, rather than showing (Clandinin & Connelly, 2000). Here is this different approach, my narrative in reader's theatre format. The major themes of being shown, learning the hard way, and getting comfortable at it are all represented here, along with some other important themes which I'll discuss further on. The subcategories and related concepts are also described. But rather than focusing on my coding categories, the reader's theatre emphasizes the workers' stories. Through these stories, the workers' understandings about learning emerge.

Narratives on Shop-Floor Learning Activities

Scene opens. There is what looks like a large piece of industrial machinery center stage. Six men and women in coveralls, and wearing safety glasses are on stools in a semicircle around the machine. With them is the interviewer, in casual dress. (He reports what I asked and said during the interviews.) Several of the workers are hidden from the audience. The researcher (this is me in the present) is at the front left end of the semicircle, in business-casual dress.

When staging this performance, I encourage the inclusion of 4 men and 4 women (the six workers plus an interviewer and a researcher), although this is not essential to the performance. There was only one woman interviewed in my study, but I encourage a more equitable balance. More equitable participation would not only make a statement about the ways that things could be in our communities—equal opportunities for all—but

would also give our audience a greater variety of people's shapes, work attire, and voices.

Almost all of the workers' dialogue is their own. I have added statements in square brackets for two reasons: first, to protect their anonymity, second, to clarify, if necessary (transcriptions are verbatim).

Researcher: It is a pleasure for me to introduce six industrial workers that I've had the opportunity to interview. Also with me is the interviewer. The eight of us sitting in this circle of chairs are having a conversation about learning activities. First of all, I will ask them to introduce themselves, so that you will have an idea of who we are.

Introductions

Blackjack: Ok. I'm married, got two daughters. Working at [ACME Marine] for 28 years. I'm into bowling, volleyball, softball. I like to travel a lot, go to casinos.

George: I guess I'm some schmo doing 30 years to life, at this point. That's the frustration level we were talking about earlier. The way it's looking now and unless there is some kind of change in the way this corporation runs I think I'll take my pension in 2 years and go on and do something different because I don't see a future here. Something has got to change drastically. They have to come up with something to make the job enjoyable again.

James: Personally, I'm a person who wasn't really interested in academics, per se. I'm more of a hands-on person. And, for example, I do all my own electrical, plumbing, finish rough carpentry (pause)—all that. I enjoy working with my hands (pause)—basically is how I would describe myself. I like to work with my hands.

Jean: When I started here I was single, on my own, living at home though. I'm married now, for 8 years, got two kids. I enjoy camping and cottaging and fishing, stuff like that. Spend a lot of time with my kids—they're still little, 6 and 7 years old.

JJ: I think I'm kind of an energetic, high energy, I think I'm a very good person. I don't talk about people, I always have a smile on my face, I try to help people as much as I can. I'm religious in some points, I do go to church. My children too, they go to a Catholic school. I'm a family man. I have a place to work, I come to [ACME Marine]. I work a lot of hours in here. I probably spend more time here than I do at home.

Rufus: I'm married with two kids. One is in high school; one is in grade school. I'm a big record collector—blues and jazz, and rock—anything but country. I've got a cottage. I'm an avid fisherman. I read just about any time I can get, from newspapers to novels. I'm a member of the Lion's Club, which I just joined last year. I enjoy that quite a bit. After 40 years or so of taking, I'm going to start giving a little bit back. Other that that, I think I'm pretty good. I've got a network of friends starting from age 20 to

age 80. People I can communicate with. I've got two or three that I keep close, people I can count on when I need them and they can count on me.

Researcher: Thank you people.

Let me introduce myself as well. I have worked for ACME Marine for over 25 years. I started as an Industrial Engineering student who was interested in improving the work-life of hourly workers. Now my interest is in helping workers, managers, and the organization as a whole, to learn. As it turns out, the experience of meeting and interviewing each of you, has helped me learn much more than I could have imagined. For that I thank each of you.

My interviews with these workers took place in the past. Sometimes it will be helpful for you to hear what I asked or said during our conversations. This role is played out by the Interviewer (*who stands and bows*).

Before we proceed with our conversation, I want to explain one additional point to our readers. It may be of interest for them to know that one of the toolsetters that we represent is a woman. One in six is about the same ratio as the number of women to men at ACME Marine. The mix is equal today because the author of this readers' theatre play wants to give you a more interesting variety of faces and voices and because he wants to encourage more equitable gender balances in the workplace.

What These Six Workers Do

Researcher: Next, I'd like you to describe what it is that you do. You are all classified as toolsetters. Toolsetters change tools, they keep the machines running, they troubleshoot problems when the machines break down. Let's begin by describing setting tools.

Jean: I just go in every day and undo all these gidgets that I'm talking about—little tooling that you're cutting the parts with. I just go in there every day and change them, flip them over and clean them up and put them all back in.

And then you got to run a set of parts and check them to make sure, because once you change the tools, the sizing can change as well. Just go in there and check to make sure they are on size. There's no knowledge needed for changing tools.

James: Well, when I first came, I had very tight tolerances that I have to adhere to and I learned how to adjust the machines to align with those tolerances. There is a lot involved, especially in my area, with hands-on adjustments, which probably won't be in the future. Right now I have to do a lot of mechanical adjustments myself.

I enjoy the fact that it's very technical that I can take a rough product and make it into a good product, shiny, new product. And have it work and have the foreman and somebody come tell me that I'm doing a good job.

"That's right on; you did a good job and now it's working really well." I like to take it from bad into good. And you get a good feeling from that.

Researcher: Is there anything else involved with the toolsetting? Rufus?

Rufus: I look after tooling on the line. I change broken drills, dull tooling, make sure that my tool board is full, so that when I do have to change a tool, I know that I can take that tooling off the line, go to the tool board, pull out a new one and be able to put it back in and get the line going.

Researcher: Most of you run more than one product. What's involved when you change over from one to another?

Jean: Just the matter of wrenching things and going into the computer and getting the number where the angle is supposed to be set at and then moving a certain part in the machine to get at the right angle that [the computer is] telling you to point at.

Researcher: So, it's fairly simple when it's computerized.

Jean: Yes.

Researcher: A small part of your job is involved with the actual tooling. You also keep the machines running. Could you describe that, Blackjack?

Blackjack: I get a lot of satisfaction, I don't know how to make this sound, but the fact that the line is running every day and they rely on you to try to keep everything running smooth. I take pride in that. I don't like to work on the line where people are disgruntled or shutting the line down because they don't want to work, or they have beefs or they have problems and all that. I like having a group of guys you can get along with and everybody can

run and then we go home at the end of the day, we're happy, we did a decent job. I don't like all the chaos in between. I don't handle that very well where people are upset or have union issues or they're getting hurt at work or (pause) I just (pause) like to see everything run smooth. And the more I can do that, keep everybody happy, keep everything running smooth, then we all enjoy working. If you have too much frustration, you don't want to come in to work. You don't want to put out, you don't want to give it all you can.

Researcher: What about the equipment itself, is it complicated? George.

George: You have dozens of parameters that are set and they have a little chart on the wall that says these are the settings and you go back and set it at that anytime you have a problem, but they don't explain what those parameters do. I can take you out there and show you parameters and they mean nothing to you, but if I take you out there and show you the actual stroke and say "now it's stroking down this far, then it expands out so far and then it starts to stroke up and down" and give you the whole process step by step and then you look at that parameter and you know what that parameter means.

Researcher: Rufus, you do quite a bit of troubleshooting. Could you describe an example of that?

Rufus: Always start with watching, The problem will occur and you'll track it down to where the actual problem is. I'll have my helper work the panel, and I'll watch what's happening.

With this one particular part, we didn't have any movement where there should have been. The first thing I did was to pick up a hammer. I gave this part a rap just to see if it was stuck. With two hits of the hammer, I did achieve what I wanted to do, it became unstuck.

We ran another cycle; that cycle it happened again. So we said, "Ok that's where the problem is." Now we look at, "are we making contact with the electrical switch that says it's unclamped?" So we are.

Now we go to the other side of the line. There are pressure valves. We turn one of the pressure valves down because we could be coming down too hard and jamming up. So we lowered that and ran another cycle. It jammed again! Now we know, that didn't happen and this here didn't happen.

Then we take the part off the line and we look at the part physically to see if we have a cracked bushing—we didn't have that.

Another thing that we could think of that could jam it was a drill that's undersized—we have locators that go into the part to hold it in place. I got the inspection gauge and slid it into one of the holes and found out that it was undersize. So I changed the reamer and we had to run a couple of

more cycles before we got that good part down to the station that was giving us trouble. Once we got that part past, we had no more trouble with the line.

It took about half an hour. We had to trace it down.

Interviewer: The process of elimination?

Rufus: Yes.

JJ: We had one the other day on the lapper on station five, the orientation on the crank shaft. It has a lock mechanism on the spindle on the headstop, for it to lock into position so the gantry will pick it up. So the collar weights are facing upward. This thing is spinning very slowly. And it couldn't find its locking position and it was faulting out the equipment. Well, it's just a matter of fact, even if I asked the person's supervisor and we capped the valve in the back, it was dirty, that's what was slowing the process. We tapped the valve and it found itself every second fault. I wouldn't have known that, I haven't been here long enough. And [the person] says "I remember about 6 months ago we had a problem with this. [Another person] was there too and he was in the front and I was resetting on the other side and tapped the valve and bingo. I mean small things like that...

Researcher: Blackjack, please describe how you work with the others on your line.

Blackjack: I work on the line that has several operations with people working on each operation. I'm kind of like a "go to" guy where if any of the machine

operators have a problem they can come to me and I can try to help them with their job or resolve a problem they may be having with the job.

I also do tooling setups at the start of the shift. They have the line prepared, so when the operators come in they can run.

[I] do part management, balancing the line, inventory, communicate between myself and the supervisor quite often. Between the machine operator and the supervisor, I'm kind of like a buffer. A lot of the times workers get frustrated for whatever their reasons may be. Maybe they can't approach the supervisor, so I can be kind of a buffer between the two of them.

Basically, I'm looking at repairs on the line, trying to keep it running, trying to make sure that everything is up to speed, recognizing when things are going to break down.

Training guys on the line now, which is when someone comes to a line new to a machine, they spend much more time with them now than they used to. I used to be like everyone else, spend your 10 or 15 minutes with a guy, show him how to do something, walk away. But I found, doing that only hurts me in the long run. If you spend the time training the person how to do the job properly the first time then there is less chance of them

coming back to me saying "I can't do this, I can't do that. This is wrong, that's wrong." I have less of that now, now they can do a lot of that on their own. So, they feel more involved and it makes it easier for me to look after my own tasks.

Basically, it's getting the line set up, working with the guys that work on the line and keeping everything running.

Learning to Do It

Experiences with Different Types of Learning Activities

Researcher: Now that we know a little bit about who you are and what you do, let's get an idea of the types of training and learning that you've experienced. I'll use the framework that I used in chapter 2, which had five types of shop-floor learning activities. On-the-job training activities involve an instructor at the work site instead of in a classroom. Participative learning activities occur at the work site and are directed by fellow workers. Incidental learning activities include situations that were not intended to teach. Educational advertising involves learning through management or union-sponsored posters or videos. And finally, in self-directed learning activities, the learner is the educator on the job site. Because some of you talked about classroom training as well, let's describe it before we proceed with the shop-floor learning activities.

Classroom training activities.

Researcher: During my interviews with you, three of you described classroom training. Blackjack, please describe the classroom training that you participated in.

Blackjack: The first thing is probably I took a troubleshooting course and with this course I was able to analyze machine breakdowns, what the cause is, who to notify to get repaired and I get it running again.

Researcher: How long did it take you to learn to troubleshoot?

Blackjack: I don't know if you ever finish troubleshooting. But the course that I took in it opened my eyes as to look at different features that will affect the outcome of whatever you're doing. That course was actually very good, that was done here at the [training center], [our maintenance engineer] I believe it was, put on a super course.

Researcher: You have another example of a training course that involved a new piece of equipment that was being built for your department.

Blackjack: We went into their facility where they were building the machine and they explained how coolant works and how the honing operation works, how would you like the electrical panels placed so you could sit at one operation and see the whole line, here's how you can troubleshoot if there's a manual, if you have a problem this is what you look up in the back of the book and it shows you, if this is your problem, this is how to resolve it.

Researcher: Strictly speaking, it isn't classroom training, but it does involve going to the place where the machines are being built and receiving instruction

from an instructor, in both a classroom environment and a shop-floor environment. George is aware of a similar training facility at another machine builder's plant.

George: They tell me they have a training center where they can send us for I don't know if it's a couple of days, or whatever it is. They can go through that whole machine, step by step. They have broken down each setup and you can get a hands-on working knowledge, which would make us twice the operators.

Researcher: What kind of classroom training did the people in your department get?

George: What they did here in [Cylinder Case] is they brought you in, sat you down in a classroom, went over the different operations and a basic overview of the whole operation, but you really didn't understand what they were talking about because you haven't even seen the equipment. We spend weeks in a classroom. Okay "this machines does this to the [case], this machine does that to the [case]," but unless you've been out and seen the equipment, how can you even ask a question?

Yeah, (pause) they give you textbooks and you read it all and you go through it and sure you get a general idea, but if they put you on the job for even a couple of days with an operator that knows what he is doing, you get to talk to them, you get to see the operation. Now, when you go to the classroom that learning is going to pick up that much quicker because you are going to have a general idea of what the guy is talking about,

you'll have questions that you wouldn't have had otherwise because you have seen the operation.

Then take them in and give them the knowledge of the book because they are going to understand when they are reading through all these manuals because some of them get pretty intense. What they are reading, they will be able to put one with the other because when you go in and just get the booklet/form taught to you. Yeah, okay you get an understanding of it, but it would be so much better if you knew exactly what everybody was talking about when you're getting it.

Researcher: JJ, you also described classroom training. You were involved in the launch of a new [outboard engine] program. This involved a lot of up-front preparing.

JJ: I was fortunate, we were all fortunate to get a lot of travelling and training with the vendors and take courses and, because there was a lot of time allowed for that at the beginning, because the equipment didn't come almost for a year previously, I mean afterwards. We were fortunate, the first seven were very fortunate to travel, take courses at [Lakeside College]. Took a lot of computer courses, which certainly helps.

And most of the people you'll talk to, whether they're in the second or third group never got that opportunity. Not that they needed it all, they didn't need all that training, but some of it they did.

Researcher: Do you have any more thoughts on classroom training?

JJ: There isn't enough classroom. You need a person that's (pause) first of all, you need a person that has the experience and has the teaching capabilities also because there's a lot of people that could have all the experience in the world, but they can't teach anything. They don't have the patience. They just can't teach. They have a hard time talking in front of people and they get nervous, they lose track of mind. Not everybody can be a teacher. And I think you need a very calm person. I spent some time with [a person] on the [Automated Case Line]. Easiest-going guy I have ever met in my life. I learned a lot from him. Lots of patience.

On-the-job training activities.

Researcher: All of you described participating in on-the-job training of some sort. Blackjack, please describe ideal on-the-job training.

Blackjack: Yeah, I would really like to have enough time for on-the-job training. If I'm going to a new area now, one of the things I would like to have is the actual time to really understand how the process runs. If I know how the process is going to run and I know what kind of product you want at the end of that run. If I know how that system is built, I know how to analyze it, and how to tackle it and how to get the most out of it. And it's always been, if the machine runs well, then the less amount of work I have to do. Some of this is self-serving. If I get that thing to run all day long and run steady and we get good parts and good numbers that means I have to do

less work. If the machine is not running well and you're constantly doing resets and debugging and working on it. I'm frustrated. I'm always working, you don't get a break. You get frustrated after a period of time. I'd like to have any person, on any job to have more time where they can actually analyze it and learn about it and have manuals available and have information available. If we can have all those good things, you can learn a lot quicker and do a better job. And all that comes down to—now you will have a better product, the people are going to be safer, they are going to be happier. Being frustrated and not having any input just kills your spirit. You don't want to do any jobs. On-the-job training, more time and more resources.

Researcher: James, describe one of your on-the-job training activities.

James: [When] I went to an area that I didn't understand, like to start a machine to run a part by hand, I would write it down as I went through it. First, with the person who was showing me, training me. As he's going through the process, I try to watch what he's doing and take quick notes of what he's doing. Just in case I run into it (pause) and that was very helpful at the beginning with that book. And through the years people have retired, tool setters and they've handed me their book.

Interviewer: That's nice.

James: But, at the time when I first started, there was no books. It was all word of mouth. All physical and verbal training.

Researcher: James referred to a notebook that he used during his training. JJ, could you describe how you helped develop training materials for others?

JJ: A lot of the manuals we created ourselves through, actually manuals that we looked at, at other plants, on other lines and we tried to make the operations, the instructions as simple as possible. Some of it you can't, it's just not easy equipment to work on. Easy to understand, logical. Like I remember [my supervisor] saying, "Keep it simple." He says I want to be able to... you write some instructions for any type of operation, I come off the street and at least been able to start this piece of equipment and operate it for a while. Now if it goes down, then I need knowledge. But, like on a cold start [instructions like these are helpful].

Participative learning activities.

Researcher: On-the-job training activities involve an instructor following some sort of step-by-step process. Participative learning activities involve learning from the people you work with. Asking questions, sharing information, experiencing problems. Blackjack, tell us what role experience has played for you in participative learning activities.

Blackjack: Over the 20 years I have had the opportunity to work on every operation on the line and I would spend a year or two on every specific job, so it was

on-the-job training,[2] [what you call participative learning,] and learning how to run that one machine and one operation. Over that period of time, I was promoted up to the [chief toolsetter] where I had knowledge of that whole system, so I know I could jump in at anytime, run any piece of equipment to keep it running. The troubleshooting part of that is recognizing when something is going to break down or knowing what to do when it does break down and how to handle that situation. Most of that is experience from day to day, the more experience you have, the more you recognize what's wrong or what you could do to fix it or how you can maintain it until you have an opportunity to fix it. A lot of times we're running production, they don't have that access of time where you can go in and fix it right at the moment. So you have got to find a way to put a Band-Aid on it and keep it running and then when you have an opportunity, when there's a window where you can get in there and fix it properly.

Researcher: George, you talked to me about a department you used to work in. One where you learned from each other as you worked together.

George: Before I came here I was in the [Die Cast] for 15 years. Between all of us down there we were all back and forth, it was like a little family, if you

---

[2] Blackjack does not have a separate term for participative learning. He does not distinguish it from on-the-job training as I do in this study. He is like many authors in the field who fail to make distinctions between different forms of shop-floor learning.

have a problem you can talk to so-and-so—he may have come across it before—there was an exchange of information.

Researcher: James, could you describe for us why participative learning takes so long?

James: Training is having somebody show you, physically, being there with you. There are some books, but they don't cover a lot, there is so much to the machinery, different little working parts that it takes a year or more just to understand how everything works. How it affects the quality of the part, the amount of parts being made.

Researcher: Learning from each other isn't always easy, is it Jean?

Jean: They usually tell you what to do, they show you what to do and then leave you on your own to figure it out the rest of the time, so it can be tough. If you have any problems [you] just ran back to that person and they helped you out.

Researcher: JJ, what about you?

JJ: I'm very fortunate the people that I'm working with on this shift are great. If they need a hand, I give them a hand. That's the way it's supposed to be. I've left a piece of equipment to show another person how a tool change is to be done and that was a request of the supervisor and that was on the weekend and I didn't shut the other operation down, but I left it to go to another piece of equipment to help them out because the line was down. If nobody knows how to repair that area, well what's the use? The other person is just going to offload parts. So, I left that area and helped

somebody else out and it took about a half an hour. We got it going, the line went, and the process flowed.

Researcher: So far everyone has experienced participative learning activities. Did you learn this way too, Rufus?

Rufus: I started off with two fellows back in '83—they're both retired—anyways, [Randy] and [Jake], if I can just use their first names. And they were good. If you asked questions, they answered them. They didn't voluntarily give information if you didn't ask anything. They took their time showing you how to run the line. When I started here on [propeller shafts], my job was also to operate the panel for [finish] section as far as starting it clamping it and starting the heads in, running the heads in, finishing the cycle off so you could keep running. They took the time to go through each step to make it work and then each time B section did go down, they were there to watch me go through the process until I was comfortable with it and then I could do it on my own without them being there.

Educational advertising.

Researcher: So far we've talked about classroom training, on-the-job training, and participative learning. We have yet to talk about educational advertising, incidental learning, and self-directed learning.

Management or unions sponsor educational advertising. An example would be management and union on-the-job safety campaigns.

Educational advertising is present at ACME Marine but none of the workers brought it up during the interviews.

Educational advertising can involve propaganda. George, you mentioned a situation that borders on propaganda.

George: When we come into the project they took us to a good old meeting and stated everything that we required to know the job would be given to us, any training, all we had to do was ask for it. Well, none of that has come true because they are getting their [production quotas] now and they figure everything is fine and dandy, but quality is suffering.

Incidental learning activities.

Researcher: Sometimes learning just happens as you work .You're not trying to learn, but you learn anyway as you do something else. This is called incidental learning. James, could you describe how this has happened to you?

James: I've never had any trouble with trades. I've always tried to work with them. Alongside of them because again that's another learning experience. You can tell somebody "the coolant is not working on [number two lathe] and walk away. He'll come to tell you when it's running, then you go run the machine. I'd prefer to hang around a little bit, not to hang over his shoulder rather, but to be there, watch what he's doing. Maybe he might explain something to me or I might ask him a question, if I have a question about why that coolant is not on, why a drive isn't working, or something

along that line. I've been working with an electrician, for example for the last two days. He has been there all day, but he has been calling me over periodically whenever he needs me. At the same time he has taught me a lot about the drives on the motor, like yesterday I learned something new about the drives and setting up following errors that I didn't know and I've been on there 12 years. And so that's a kind of intensive job—you can still learn things 10 years down the road. Still, we're always learning with that sort of thing. Always.

Researcher: George, you mentioned incidental learning too.

George: Part of it you can pick up over the years because you worked on different, various machines, you can pick up the pneumatics and the hydraulics and the electrical parts because somewhere along the line you worked on a similar operation. So that part you basically understand.

Self-directed learning activities.

Researcher: Much of your learning is motivated from within. Much of your learning is self-directed. Blackjack, could you describe how you just weren't satisfied with the training you received or what you learned from your fellow workers?

Blackjack: I was never satisfied with just sitting doing a job, I wanted to know how it ran or what this accomplished by doing this, what was the end result. I was always looking at the bigger picture rather than just doing the same thing.

Researcher: George, you also described wanting to make yourself better.

George: We keep striving to make ourselves better, but when we do have a problem and say "look, I don't understand this portion of it" say surface finishes. "Can I speak to an engineer so I better understand so that when I do have a problem with the surface finish I know where to look to go in and rectify the problem."

Researcher: Thank you, George.

We have been talking about the types of learning that occur at work. Half of you have been involved in classroom training. It typically precedes the arrival of new equipment. In this situation, a body of knowledge does not exist within your department, so it needs to be brought in by outside instructors.

All of you have been involved in some sort of on-the-job training, step-by-step instructions that are delivered by someone who has been trained in some way to deliver them. More often than not, this training just covers the basics. Sometimes you're given instruction sheets that you're asked to follow. On-the-job training for you is being told what to do. You learn how to do it through participative learning with your coworkers.

All of you have described to me both good and bad participative learning experiences. We've heard some of them here. Participative learning activities for you involve the day-to-day experience of being shown. I will

ask you for more clarification on the subject of "being shown" in a few minutes.

Educational advertising doesn't seem to be involved in your descriptions of learning. George is the only one who remotely alluded to it. Finally, self-directed learning activities seem to be a large part of all of your jobs. You all described situations where you took the initiative to learn on your own. You all wanted to get better at or comfortable with your jobs. This part of your learning experience is often very frustrating. You struggle to get the knowledge and experience you need to properly do your jobs. We'll come back to your discussions of "getting comfortable" in a few minutes.

Sometimes there are fine lines between the different types of learning activities. There may be little difference between someone instructing you, as in on-the-job training, or helping you, as in participative learning, or answering a question, as in self-directed learning. The main differences between on-the-job training, participative learning, educational advertising, incidental learning, and self-directed learning, are associated with who is directing the learning activity (the educator as I described in chapter 2) and the nature of the activity. Another way of describing your learning is to talk about what is happening during the activity. That is what

we will do next as we talk about "Being Shown" or "Learning the Hard Way," two phrases that you've used to describe your learning at ACME.

Being Shown

Researcher: Blackjack, could you describe what happens when you're being shown how to do something?

Blackjack: A lot of the times you would be placed on a job with someone who has previously done that. [They] would show you, this is how you do the job. And due to the manpower or time shortage or whatever, most of the time the training was very brief, just enough to get you going. And you kind of learn on your own as you go along and learn from your mistakes. With training in that respect, for learning jobs is not very in-depth. It's just "here you go, here's how you do it and away you go." Over the years it has gotten better, we're learning more, and they are spending more time showing them how to do a job and they have job instructions now, but previous to that there was just "go see this guy, he'll show you how to do it" and he walks away. But I was never satisfied with just sitting doing a job, I wanted to know how it ran or what this accomplished by doing this, what was the end result. I was always looking at the bigger picture rather than just doing the same thing.

George: [May I jump in?] This is where the training will actually help, is to see these problems coming and to throw you up there and "push this button, that button," that's fine, but they showed us (pause) well for basics when they put us up on the job you went with a fellow who says "this is what

you do to start it, here's how you adjust the size" and that's the way it was left.

Researcher: James, you have a good example of being shown.

James: Training is having somebody show you, physically, being there with you. There are some books, but they don't cover a lot...there is so much to the machinery, different little working parts that it takes a year or more just to understand how everything works. How it affects the quality of the part, the amount of parts being made.

Jean: Most of the people that I trained with were pretty good. They were there whenever I needed a hand, they were there. They tell me, show me exactly how much to make my adjustments on my gauges and they were pretty good.

Researcher: Why is being shown not always a good experience?

JJ: Somebody shows them the basics to get by. That's it.

Rufus: Oh, since I've started here? Well, I started off on bearing caps. It was assembly work. Now the one fellow showed me how to start the job and like, the procedure, how to put the caps on and then after that it was up to me to find my own way that I could do it comfortably, or quicker—whatever worked more convenient for me, but he showed me just the basic way of putting it on.

In most cases everybody's been really good, you know, taking the time to show you, taking the time to make sure that you verbally understood what

they were saying and then having you go back and physically repeat what they just showed you by pressing the buttons and stuff like that and then just giving you little bits of what's happened with them over the course of them running the line. "This particular problem may occur and this is what'll happen when it does and this is what you'll do to solve it." But most of the time you actually have to wait for it to show up.

Researcher: Why is "being shown" such an important aspect of learning?

Blackjack: Training guys on the line now (pause), which is when someone comes to a line new to a machine, they spend much more time with them now than they used to. I used to be like everyone else, spend your 10 or 15 minutes with a guy, show him how to do something, walk away. But I found, doing that only hurts me in the long run. If you spend the time training the person how to do the job properly the first time then there is less chance of them coming back to me saying "I can't do this, I can't do that. This is wrong, that's wrong." I have less of that now, now they can do a lot of that on their own. So, they feel more involved and it makes it easier for me to look after my own tasks. Basically, it's getting the line set up, working with the guys that work on the line and keeping everything running.

Researcher: Being shown is an important part of experience. Another part of experience is how we participate with the people around us. You've described experiences where participation was good. I'd like to talk about what happens when you're not involved.

Learning the Hard Way

Researcher: You've described the alternative to being shown properly as learning the hard way. Let's talk about that for a while.

Blackjack: The Okono when it was installed, bought the machine, brought into the plant, here you go, run. Didn't even know how to start the panel. I had no one there to show me how to do it. Once we got the panel to work, we got a cycle out of it. Now, how do you make adjustments, how do you run this equipment? We had no idea, found out a lot of it was out of [specification]. We're running pressures on hydraulic lines that are not allowed in [ACME Marine]. There's just a numerous amount of problems with that.

We went out and bought the equipment, put it in, here you go, run it. Job training was nonexistent. It was just here you go and I had like three or four days to get this thing running before everybody came back from holidays and then we got to run. That was a panic time. Trying to learn on your own, nobody to go to, no manuals to read. No reference for anything. Didn't even have a vendor that we could call to say well, "How do you do this or how do you do that?"

Even the electricians didn't know how to run it when it was brought in. We had [PLC-2s] that they didn't know how to program (pause) that moves on the [Servadrives]. Even the electricians in the plant didn't know

how to run the system. And I learned by trial and error and I'm not even supposed to be in there. And I'm learning how to do that and showing electricians how to make program changes. None of that should have been like that. People could have gotten hurt, machines could have went down, we were lucky that we got them to run, we all learned, but that's an awful tough learning curve. Try to get the machine up and running and quality parts all at the same time.

George: The training is nonexistent. It's not like it was when they first started. It's gone to the point, it's gone back to the old school where we have job-"B" open. We have to move a man over there so, you move him over there and you kind of put him with a guy who has been there so he's there for a couple of days. Then the guy is on his own to learn the hard way. And he will learn the hard way. It's a matter of time.

JJ: The frustration I had when I was on the [grinder] on a Saturday, a different [line]. I sort of spent a bit of time on [line] 1 and I was on [line] 2. I had a problem, never seen it before. Saturday morning, asked an individual to help me and [he] almost told me where to go. That individual is a person with less seniority. So I went to [line] 1 and asked another individual to help me out and he did, thank God.

Rufus: When I did start running the [Okono] I didn't know the thing at all and stuff would happen and I'd have to figure it out on my own. So when I went back to the [CNC Hone] I was happy but I stayed over there for another 3 years before they brought me back to the [Okono] and when

they brought me back there was no toolsetter at all to show me anything so I had to learn cold. Now luckily I retained some of the stuff I remembered but it still took me at least a good month or two to get comfortable with it before I wasn't thinking about putting in a transfer every day when I went to the [garbled phrase with laughter].

Getting Comfortable At It

Researcher: Interesting that you used the phrase getting comfortable. Many of you mentioned it. You described this as you talked about "being shown." It was also the case during "Learning the Hard Way." Eventually however, you got "Comfortable at it." Let's talk about that. James?

James: When I was successful in gauging myself, calibrating, running the gauges through the plant, calibration myself because there is a lot involved with different buttons and codes that we are supposed to put in. Once I was comfortable with doing that, then I was able to gauge, easily, after that. The biggest part being the calibration of the gauges and making sure you are using the right gauge in the right spot. And once I went through all the paperwork and was able to fill it out easily, then I felt comfortable.

Researcher: Jean, you described what happened when an engineer made a programming change to your machine. What happened?

Jean: I'm expecting them to put it back to the old program, to leave things the way they were because that's how I was comfortable running them.

Researcher: How long does it take to get comfortable?

JJ: Most guys will take a year to two years before they feel comfortable. So now I've got a range in myself how long it's going to take me. And if I stay to it and if I work with those individuals I should be just as good.

Researcher: Rufus, you described how a fellow helped you to get comfortable at it when you started about 20 years ago. Could you describe the experience?

Rufus: Oh, since I've started here? Well, I started off on [Props]. It was assembly work. Now the one fellow showed me how to start the job and like, the procedure, how to put the caps on and then after that it was up to me to find my own way that I could do it comfortably, or quicker, whatever worked more convenient for me, but he showed me just the basic way of putting it on.

Researcher: You also described two people who are now retired.

Rufus: They took the time to go through each step to make it work and then each time B section did go down, they were there to watch me go through the process until I was comfortable with it and then I could do it on my own without them being there.

Books and Instructions

Researcher: We have talked about how we learn from other people instructing us or showing us. We've talked about learning on our own, learning the hard way. Sometimes people learn by reading things in books or through written instructions. Let's talk about books, manuals, and instruction sheets.

James: Well, it's good to have written, but it's also good to have somebody with experience there to help you along with the questions that aren't covered in books and we tried to do a book here on the line. There is a book. There's a lot of holes in it because you just can't get everything in. Either you can't think of it all the time when you're sitting down, trying to verbalize everything or you just don't think about it. There's so many aspects to it.

[Once I worked with someone who ran into a problem]. Well, he looked at it for a couple minutes and then he went running for the book and he desperately, ruffling through the book, trying to find a reference on what to do with that and believe it or not, for the next 8 hours he tried to reset that machine so that it would run, keep getting the same fault over and over again and he'd just keep running back to the book. This giant book that he had.

And it wasn't a book reference, it was an independent thought that he should have had. You know what I mean. He should have looked at that and said, "Yes, I'm going to need a millwright to come out and fix that door." You can actually see the door is hanging. He disregarded his visuals on that. For whatever reason, I don't understand why. They totally disregarded seeing that door hang. And he desperately tried to reset that machine and look through the book to find an answer of what to do.

Researcher: Rufus, when are books helpful?

Rufus: There are manuals for setting up of tooling, ordering tooling and stuff you need. Yeah, there is books you can go to as far as stuff like WHMIS [Workplace Hazardous Material Information System] which involves chemicals and stuff that may be in the department, the oils and stuff like that. If I'm not sure about something like that I can go in and find out about it from the office. Ordering tools, I can go in and open up a book and find out what I need. The job description for the [Prop Shafts] and the loading stations are all there—you pick up two [Props], put them in your hand, two, you put in four bolts, three, you attach them to the [Props], four, repeat process and that's that.

George stands quickly and says to Rufus, slowly raising his voice.

George: We have all the manuals to go through, (pause) but the problem is when you go through the manual, (pause) [you go through it over and over again] (pause) and you can't find the [damn] answer!

Researcher: Thank you George, I think the audience now empathizes with your frustration. It's time for a break. Let's have a 15-minute intermission, grab a coffee. Feel free to come up on stage and talk to us or ask us questions. When we resume, we'll change the focus from the group as a whole and concentrate on each individual. They'll each describe a best case of learning, and then a worst one. The chasm between best and worst should

give you a better understanding of how each individual understands learning.

Intermission

Individual Cases

Researcher: Three of you are working on equipment that's been in the plant for quite a while. I've noticed a difference between this situation and the one where new equipment is purchased and installed and debugged. Jean, we'll start with you. Please describe your best case first.

Existing equipment.

Jean: Oh yeah. Even just standing in front of your window and watching it run to see exactly at what point it's doing this and cutting the parts. Just by watching it you can learn.

Most of the people that I trained with were pretty good. They were there whenever I needed a hand, they were there. They tell me, show me exactly how much to make my adjustments on my gauges and they were pretty good.

I'm a toolsetter operator, but we have another person here that if I am having a problem I can go to him for help and he comes down and the two of us will discuss what the problem is and figure out who to call and if we call the wrong person, well that person will tell us.

Researcher: What about worst cases?

Jean: I found if two or three people were helping me out (pause) then it was just because each person has a different way of doing things. And some were taking shortcuts and throwing me completely off what I was supposed to be doing—so it's better off if you're going to train with somebody, train with one person.

[Another problem is with engineers.] The engineers come down every once in a while and they change the program in the back of the machines, so being on them so long you're used to the machines running a certain way. All of a sudden he changes something and then it starts doing something different on you. It's like I have to retrain myself so that (pause)—that I find tough and nobody ever listens when I complain about them doing it.

I've been doing the same steps for so many years, now I have to do something different. That's not an easy thing to do. I'm still trying to get used to one program [change] he did a year ago.

It was on the panel, you've got 1 to 20 and you push 1 and it does this and you push 2 and it does that, you go in order all the way to 20. That's an easy step to follow. He changed it, now I have to go 1, 2, **13**, 3 (pause)—

that's a hard thing to remember sometimes. If I don't push 13 the parts just all fall out.

Researcher: Perhaps the engineers in the audience can keep Jean's frustration in mind when making changes to the way machines or systems operate. Thank you for sharing your story with us, Jean. James, could you describe your best case about learning? You described gauging. (*To the Audience)* Gauges are used to measure specific dimensions on parts. When they gauge a part, toolsetters remove the part from the machine and place [it] in a gauge.

James: Well, actually [gauging is] not learned, it's a prescribed area, they tell you how many times you have to gauge. *(Looking up at the audience.)* I found that I should gauge more than was prescribed.

How it was done...there is documentation on the floor, but it was easier for me to learn from somebody else. Describing it to me, showing me.

Interviewer: Is that what happened?

James: Yes. Actually physically showing me how to do it. I could read it, probably get the same understanding, but I feel better having somebody show me.

When I was successful in gauging myself, calibrating, running the gauges through the plant—because there is a lot involved with different buttons and codes that we are supposed to put in. Once I was comfortable with

doing that, then I was able to gauge, easily, after that. The biggest part being the calibration of the gauges and making sure you are using the right gauge in the right spot. And once I went through all the paperwork and was able to fill it out easily, then I felt comfortable.

[Like I said earlier] training is having somebody show you, physically, being there with you. There are some books, but they don't cover a lot...

I have in the past, well the first year I used a book and as soon as I went to an area that I didn't understand, like to start a machine to run a part by hand, I would write it down as I went through it. First, with the person who was showing me, training me. As he's going through the process, I try to watch what he's doing and take quick notes of what he's doing. Just in case I run into it ...and that was very helpful at the beginning with that book.

In my department making pins and cranks/mains there's two toolsetters. We both do the same job, with the same responsibility. So, we play off each other. What I don't remember, he'll remember or if he sees me doing something I'm not really supposed to, but I don't think of it, I don't remember, that hey I'm supposed to adjust something before I do something else, he'll remember. The main thing is we play off each other.

Researcher: Thank you, James. What about a worst case? You described some of the people you work with.

James: The bad ones were really bad, they would leave notes and be very nasty. The good people were the total opposite. They were very helpful and very supportive.

I think that's just personality. Different people. Some people I think, felt threatened.

Interviewer: That you were going to take their job?

James: Well, I'm pretty good at it. So, it was easy for me to pick it up. See, I have experience on the [Cylinder Case] line. I was on the [Cylinder Case] line for 7 or 8 years, machining. That's just about the same as we're doing here, more or less. So, I came with a lot of experience to begin with and possibly afraid of losing their own job. I didn't let it bother me.

Well, I'll have to revert a little bit back to this gauging, sizes, setting up sizes and working within that small tolerances. Because it's so complicated, a lot of times you don't get it done in one shift so you have to carry over to the next shift. Now a guy on the next shift was out to get me. So he would ridicule anything that I left over. So, it was really stressful. 'Cause the next day I'd come in and I don't know what kind of (pause) and this fellow had more experience than me, had more seniority and what not. I didn't know what to expect the next day when I went in because he would either leave notes in the book or leave a machine down

for 16 hours and blame it on me and not try and fix it. That was probably my worst, dealing with other toolsetters that are out to get you. And it happens a lot.

Interviewer: What would you do about that? How would you improve the situation or what can be done? What can someone else do?

James: Well, with me I just wore them down. I just didn't care what went on. I just continued to the best I could. I just ignored any kind of negative aspect they or he tried to put against me. Kept going.

[I] kept going and [he] eventually gave up. [He] got tired of it because [he] realized that it's not getting anywhere. He's having to work too hard, he ain't getting anywhere. He ain't bothering me.

I just wore them out and then eventually he started helping me.

Interviewer: Really?

James: Yeah.

Interviewer: This guy is not going away. He can help me too.

James: Yeah. Basically, over years. We worked together for 10 years or so.

Researcher: Thank you, James. I admire your determination.

Rufus, please describe your best case.

Rufus: Yeah, the best was I started off with [those] two fellows back in '83, [Randy and Jake, that I already discussed...as I said] they were good. If you asked questions, they answered them. They didn't voluntarily give

information if you didn't ask anything. They took their time showing you how to run the line....They took the time to go through each step to make it work, and then each time B section did go down, they were there to watch me go through the process until I was comfortable with it and then I could do it on my own without them being there.

It's just a matter of observing and repeating and remembering. [For example,] the electrical panel, the start-up panel. If you can't operate the panel, then you can't operate the line. You have to have certain buttons that follow sequence. When you go out of sequence then nothing happens. You got to start back in the beginning again. So, it's just a matter of remembering 1, 2, 3, 4, and so on. But if you don't know the panel, there's no point in knowing the rest of the line.

At the beginning I did write some stuff down—where some of the solenoids were located that gave us more problems on the line. Solenoids are little hydraulic gadgets that make the head move back and forth and some of those are hidden and you've got to remember where they are. Putting everything back in its proper place on the tooling board and labeling different tools, and different set-up gauges for when you're changing a drill. You have to know that there's a turret that that drill fits in to so you can sling this gauge around and when the drill comes flush with that one turret you know you've got the thing set up properly.

Researcher: Describe when you are finished learning.

Rufus: I'm not finished. I'm still learning stuff every day. You know, something pops up that you've never had happen before. Today, we were having trouble with a clamp. It was just a process of elimination. You knew where the problem was but it kept reoccurring so you had to trace it back and adjust this valve or loosen the pressure on that clamp. We ended up tracing the problem back to a drill which was on an entirely different head from where we were having the problem. It was a matter of finding the problem and working backward to get it fixed. So there were several things we had to do before we had it figured out.

In most cases everybody's been really good, you know, taking the time to show you, taking the time to make sure that you verbally understood what they were saying and then having you go back and physically repeat what they just showed you by pressing the buttons and stuff like that and then just giving you little bits of what's happened with them over the course of them running the line. "This particular problem may occur and this is what'll happen when it does and this is what you'll do to solve it." But most of the time you actually have to wait for it to show up.

Well, we've got, for the inspection, we have sheets with instructions that are mounted right at the inspection tables. You follow that one - 1, 2, 3, 4 (pause) and that will give you all the parts on the carrier, which is what we

make here, that you're supposed to check. As long as you follow those instructions, you'll be fine.

As far as the panel goes, I don't think there are instructions. If someone were to walk in cold off the street, they couldn't start up the line because there isn't anything written down to actually show them how to do it. It's just been "watch and repeat" since I've been here.

Interviewer: What do you think is the best way to learn?

Rufus: Oh, to show and tell.

Interviewer: When you say "they trained you" what does that mean?

Rufus: The toolsetter trained me how to become a spare man.

Interviewer: As you've described?

Rufus: Yes, it was just "follow and observe."

Researcher: That was your best case. What is your worst? It involves some dialogue. Let's ask Jean and George to help act this out.

Rufus: The worst example was the toolsetter who previously trained me. He was one of these trial and error guys.

George: He'd say, "OK, there's the panel, show me what you know."

Rufus: And I'd say, "I don't know anything. I've never worked on this line before."

George: "Well, you worked on the other line. You have to know something."

Rufus: "Yeah, but these are two totally different lines. This panel is like day and night compared to the next one. I haven't got a clue other than to press the start button and where do I go from there?"

George: "Well, you figure it out and if you need me I'll be sitting over there."

Rufus: And I said, "Well, OK. I've figured out right now that I need you to show me how to start this thing up because I'm not going to start it up and smash the thing."

So after a bit of arguing back and forth and getting a supervisor involved (*Jean stands up and walks to a spot between Rufus and George*), he had to physically show me how to start the line.

Now that took a couple of weeks to learn all the ins and outs of everything and then I got shipped back over to the other line.

(George and Jean return to their seats)

That was just him. He had to be different from everybody else that was in here. If everybody said the sky was blue, he'd say it was orange. That was just the way he was. He thought that the best way to learn was by jumping into the water instead of putting your toe in first. It frustrated the hell out of me.

Interviewer: When you got the supervisor involved, how did the supervisor help resolve the situation?

Rufus: The supervisor told him that the work description that was written down, said that the toolsetter will give proper instruction on operation of the line. Well, proper instruction wasn't sitting down and getting up when I yelled for help.

Researcher: Thank you, Rufus. Thanks also to George and Jean for helping Rufus tell his story.

Looking directly at the audience.

Researcher: The purpose of these stories is for Jean (*stands*), James (*stands*), and Rufus (*stands*) to share their experiences with you directly.

They walk to the front of the stage. Jean on the left. James at the center. Rufus on the right.

Please now express your thanks to each of them. *(Suggests that audience applaud by raising arms somewhat and making clapping motions.)*

Jean, James, and Rufus exit.

<u>New equipment.</u>

Researcher: Blackjack, George, and JJ happen to have worked on new equipment. They were not chosen as participants in the research for this reason. Their stories are similar to Jean's, James's, and Rufus's stories, but because their situation is different (new equipment instead of equipment that's been operating for a while), their learning experience is slightly different. Blackjack, could you begin by describing a best case?

Blackjack: That was the [CNC] hone, where they actually took us into their plant. We had several suggestions on how to build the machine, how we would like

it laid out, how it would be more comfortable for the worker. We did a run off, we actually ran parts within their plant, we were trained on how to run it.

Researcher: *To audience.* A runoff involves making good parts on the machine before it gets shipped to ACME Marine.

Blackjack: When they brought [CNC] into the plant, we were up and running right off the bat. We had everything, we had the training, we had the on-the-job training, we had references, we had manuals to go to. We went into their facility where they were building the machine and they explained how coolant works and how the honing operation works, how would you like the electrical panels placed so you could sit at one operation and see the whole line, here's how you can troubleshoot if there's a manual, if you have a problem this is what you look up on the back of the book and it shows you, if this is your problem, this is how to resolve it. Hydraulic layouts, electrical layouts, everything was up on the deck that we worked on. So, anytime that I wanted information I had it right at my hands.

CNC hone comes in, put it on the floor, that week we're running full production right off the bat. Big difference. So, there's a best case, worst case. Where one is job training, they actually go into their facility, they show you how to run it, they show you how to make parts, they show you how to correct problems. You basically know how to run the machine when they install it within our plant.

I wasn't as involved as I am in now. I didn't know my process engineer, I didn't know my electronics engineer. These people that are involved in buying the equipment, and getting the process brought into our plant. I was just another guy on the line. I really didn't have a lot of knowledge or a lot of input. I didn't even know who was responsible for doing this. But since then when the [CNC] came in I was involved with, not so much the purchasing, it was already purchased, but the layout, how it was set up, how it was going to run, how are you going to get cycle time, what type of tooling to use. My input was just...every day they were turning around, asking me questions of how I thought, how we can make this better and we learned a lot from it. So, it was like night and day. One system runs with no input, no information, just lost. And the other one was I'm totally into the whole project.

Where with the other way, they throw you in, run it and you're lost. You don't know where to go, what to do and just a number, but now you feel more like part of a team. I know that's not always the right buzzword, but you know what I'm getting at. You're more part of a group, now you're more responsible to make it run. It's kind of like you have some pride in it. There was none of that before.

Researcher: Tell me more about your worst case.

Blackjack: The [Okono] when it was installed, bought the machine, brought into the plant, here you go, run. Didn't even know how to start the panel. I had no

one there to show me how to do it. Once we got the panel to work, we got a cycle out of it. Now, how do you make adjustments, how do you run this equipment? We had no idea, found out a lot of it was out of spec. We're running pressures on hydraulic lines that are not allowed in [ACME]. There's just a numerous amount of problems with that.

The Okono was basically done by the plant itself. We went out and bought the equipment, put it in, here you go, run it. Job training was nonexistent. It was just here you go and I had like 3 or 4 days to get this thing running before everybody came back from holidays and then we got to run. That was a panic time. Trying to learn on your own, nobody to go to, no manuals to read. No reference for anything. Didn't even have a vendor that we could call to say well, "How do you do this or how do you do that?"

On the [Okono] we had nothing. And then we had the [PLC] system, that even the electricians didn't know how to run when it was brought in. They didn't know how to program —it moves the [Servadrives]. Even the electricians in the plant didn't know how to run the system. And I learned by trial and error and I'm not even supposed to be in there. And I'm learning how to do that and showing electricians how to make program changes. None of that should have been like that. People could have gotten hurt, machines could have went down, we were lucky that we got them to

run, we all learned, but that's an awful tough learning curve. Try to get the machine up and running and quality parts all at the same time.

Reseacher: Thank you Blackjack. JJ, you're next. Please describe your best case.

JJ: I was fortunate, we were all fortunate to get a lot of travelling and training with the vendors and take courses. There was a lot of time allowed for that at the beginning, because the equipment didn't come almost for a year. We were fortunate, the first seven were very fortunate to travel, take courses at [Lakeside College]. Took a lot of computer courses, which certainly helps. Well, the [training coordinator] through [Lakeside College], he organized all our courses, asked us what we wanted to take, told us most of the time that the vendors were in, where we could take courses. I worked with an individual that originally was working I think in Hamilton. He was a consultant and I had mentioned him to [the training coordinator] and we took a course from him and eventually he got hired at [Lakeside College]. 'Cause he was that good. We took a few courses from him. Actually, when [Lakeside College] got their first CNC machine installed on [their machine shop floor] we were the first ones on that piece of equipment and we were trained to program an "absolute" and an "incremental" and how to cut parts.

So, when we got on the floor, we had an idea of what was going on. Some of us had taken it previously. I took it in trade school and was very fortunate. I started taking CNC machines in 1989 when I had my trade in

here. I went through our apprenticeship program in 4 years and then we got laid off in 1993. [Cylinder Case] started in 1995.

[Like I said before,] there isn't enough classroom. You need a person that has the experience and has teaching capabilities.... And I think you need a very calm person. [Like the person I mentioned before,] I spent some time with [him] on the [Cylinder Case]. Easiest-going guy I have ever met in my life. I learned a lot from him. Lots of patience.

Interviewer: This was sort of one on one?

JJ: One on one. But, it still takes time to, even when you're on your own. It takes quite a while. This is not like assembly work, you put the same part on every day. You might get a fault that you haven't seen in a year. Then you've never seen it before. There's not really a manual.

You try your best of all the knowledge you have to resolve it, if you can't you look at any manual that's around that might have a hint in it and then you call your supervisor. And he'll usually get you or you ask people around that work in that area, "Have you ever seen this fault before?" The odd time somebody will say "yeah, this happened to me 8 months ago. You do this, this, this."

Researcher: Describe your worst case.

JJ: Somebody shows them the basics to get by. That's it.

Interviewer: And then after that?

JJ: They learn on their own. There are manuals there. I don't know if they are up-to-date or not. I could tell if I read one right away. 'Cause the programs are always changing, they're always changing when they introduce a new machine. They might take a tool from a previous machine and introduce it to this machine to increase cycle time. So, a lot of the times on the [Cylinder Case] they were changing things around to get cycle time, to make more parts. That's the right thing to do, I mean, that's what we're here for. To make as many parts for [ACME Marine] and for them to make a profit and for us to get paid decent wages. And if they don't make profit, they don't make parts, we won't be here. That's what it's all about.

I've had an occasion when someone wouldn't help me. Almost told me right to my face that one of the reasons was I have more seniority and he felt threatened: "Why should he help me?" Because he might be losing his own job.

Interviewer: You mentioned before knowledge is power...

JJ: It is.

Interviewer: That kind of thing...

JJ: ...A lot of people use that...

Interviewer: Afraid to give you knowledge because...

JJ: ...and especially if you have a reputation coming from another department that you learn quick and you pick up fast. You know a lot of people want to see you struggle—they do. And a lot of people don't.

Researcher: Thanks JJ. George, what about your best case?

Interviewer: Have you ever had a good department or worked in a department where people did talk to you?

George: Definitely, before I came here I was in the [Die Cast] for 15 years. Between all of us down there we were all back and forth, it was like a little family, if you have a problem you can talk to so-and-so. He may have come across it before. There was an exchange of information.

We're asking to just simply be trained by the proper people because although secondhand knowledge is good sometimes it just isn't as good as if you've got a technician that knows what they're talking about. Like if I was to ask you, you could say, "yeah, you do it this way." But maybe somebody else has got a better idea of how to do it. When we were working in the other area, we had six or eight people and you could get his idea, his idea, then you could formulate your own idea and you worked around problems like that. If I run into a problem, I'll talk to the guy on the next shift because that's the way we always did it. Share information.

Interviewer: Why was it more shared in the [Die Cast] than it's being shared here? Have you thought about that at all? You describe it as being like a family. You're all working on the problems together.

George: It was more of a team in there. It was a smaller group to start with. You only had ten guys. And we run the thing ourselves over there, there was no

supervision other than on days. There was a day shift supervisor. We knew what was expected of us and that's what we give them, just to keep them off our backs. We basically ran that department. Whatever they needed they got because they left us alone and that had a lot to do with it. But, then it was a more open environment where people would share their information because no one wanted to deal with the problems with supervision coming around saying "why wasn't this done, why wasn't that done?" We all knew what was expected and if we could get along that way it was fine.

We had the engineer steady. The engineer was always there. He was on the floor anytime you needed him on day shift. And if you had a problem you could go to your supervisor, they would get you an engineer out. They would tell you go see so and so, he'll be in at 2:00 or whatever. And when you get in there, you can talk to the engineer and it made us be a better operator. They give us better skills.

Interviewer: Sounds like your problem is with too much management. With [Die Cast] it sounds like you ran things on your own.

George: It was. That's exactly the way it was. It was great there for that simple reason. We had a manager on days and he took care of the overall problems with the paychecks and what not. He would be there at the start of your shift and then he would be gone and you just run on your own. For one, I liked it better myself because you didn't have pressure of somebody always doggin' you. You knew what you had to do, so you just did it to

keep them off your back, basically. But, I think the biggest thing over there was everybody worked together to accomplish that.

Interviewer: You knew what the goal was.

George: There was a team over there. Over here there's [only] a team concept (*voicing frustration*).

Researcher: Before we begin to discuss your worst case, let's talk about what you said to me before the formal part of our interview started.

Interviewer: You mentioned on the line that you don't want to come across as being a negative person.

George: No, because the way the training is going out there or the nonexistence of the training in my view is just ridiculous. We're all out there trying to give our best because that's the way the jobs go these days. We're not only required to do the job, we have got to constantly improve to be competitive, otherwise we're not going to have a job.

It seems like the corporation doesn't take that attitude, they keep falling back to the old routine—are we getting the numbers? If not, why not?

They won't go back to the actual training and say look if we ask for additional training, when we come into the project they took us to a good old meeting and stated everything that we required to know the job would be given to us, any training, all we had to do was ask for it. Well, none of

that has come true because they are getting their numbers now and they figure everything is fine and dandy, but quality is suffering. We're throwing out scrap parts and all I have to do at that job I'm on is throw ten scrap parts a day and I could have paid for a week of training, so why not give me the training so when a problem occurs I know how to look after it?

Instead of just guess because that's all it is now. We're trying to work through it, we learn by our mistakes, but if you've got to guess all the time and you ask for an engineer to come down, that doesn't happen. I mean they've got all this high priced help and it's all knowledge based, it should be simple. If we ask a question, they should be able to get us an answer for it.

Interviewer: So that's why you said "I'm a worker who wants to do a good job, but I'm not very satisfied with the training that's happening and so I don't want to come across as being negative." The reason I did this is so we start on that basis.

Researcher: That said, please begin to describe your worst case. Blackjack, would you mind helping George by reading his quotations?

George: We keep striving to make ourselves better, but when we do have a problem and say:

Blackjack: "Look, I don't understand this portion of it,"

George: say surface finishes.

Blackjack: "Can I speak to an engineer?"

George: so I better understand, so that when I do have a problem with the surface finish I know where to look to go in and rectify the problem. They basically say,

JJ jumps in to help. He speaks George's supervisor's words.

JJ: "yeah, OK"

George: and it goes on the books and it's never done. That engineer is never contacted, you never see anybody, it's like they are hearing you but not listening to you.

And it gets so frustrating when you ask time and time again, get out and they write in their little book,

JJ: "yeah, we'll get so-and-so to come out and talk to you."

George: Well, so-and-so never appears.

And this is one thing that is getting really ridiculous to the point where, now they just keep saying,

JJ: "well now you can do this job, you can do this job with it."

George: Well, I haven't even learned this job. Sure, I can go up there and I can give you your daily cycle count, so you put me on the board—

JJ: "he knows that job, because he can get out the numbers."

George: And this is what happened out here on these particular jobs. They are just throwing people at them. As one person leaves, they just say—

JJ: "OK we have an opening here, would you like to go up there?"

George: You go up there, they'll put you up there for 2 days, if that machine runs good for 2 days,

JJ: "oh yeah, you know it, next guy."

George: And you really don't. It's so frustrating because you're trying to do the best you can do because that's what is required anymore. Yet they at the same time, they don't want to give you that training to bring you to that point.

Had they have trained me when I seen that problem happen I could have reacted quicker, I could have reduced the scrap and increased the quality, but they don't look at it that way. Because I can run the general numbers, they figure I'm qualified to do the job and I'm not. And when you tell them that, look, I need to talk to somebody to better understand the job, they don't have time for you.

I mean this area has been open for 3 years, yes, but the people that were originally trained with the demonstrators, some of them have retired, some of them are gone. You can't go to those people and ask and to bring in the people from [Okono]—they are saying it's too much money to bring them back.

But, we need somebody with a more technical knowledge to give us because we're not getting it off that piece of paper.

Interviewer: By "training," you're talking about having a conversation with someone.

George: Just a conversation with somebody because the knowledge he gives me is going to help me do the job better and they don't seem to see it that way. It's like, well, you've been there and you mean to say you don't know. I might come across something that makes his life easier. We're looking to make that job as easy on us because why should we run around after our tail when the information is out there. It's finding the information and there's a total lack of it. It's like they don't want to cooperate with us. That's where the engineer comes in—see he ran that machine off—he's got a basic working knowledge of it. And the longer he stays away from it the less that knowledge becomes, it's not retained. So, now is the time to get it. Not 6 months from now because he's going to say—

Blackjack: "geez, I knew that, but I can't remember it."

George: And I even talked to the people from [Okono] when they come in periodically, when they come in for some reason, they just happened to be walking through and they tell me they have a training center where they can send us, for I don't know if it's a couple of days, or whatever it is. They can go through that whole machine, step by step. They have broken down the setup and you can get a hands-on working knowledge, which would make us twice the operators. Give them the better quality, but they don't seem to figure it's required because they are getting their numbers.

When it breaks down, that's going to be the difference between me and the regular guy operating. He's going to fix it faster than me because he has the current knowledge because it evolves on a daily basis. Things are constantly in change and they don't see it that way.

JJ: "Well, you were on there 6 months ago, you can go back over there."

George: Well, in 6 months you've had so many other jobs, so much else on your mind you don't remember the little things that make that job go quick, to keep the job going. Simple little stuff that we learned the hard way.

Well certain faults [indicators] will come up on the machine and you know exactly where to go and look. Where the other guy that hasn't been on that machine he's got a call for a trade, the trade has got to go through all the [hundreds of lines of computer program coding] and what not, to locate the problem.

Whereas, as soon as that fault comes up, because I have been there and I'm current on it, I can walk over and hit the button and the machine goes back and starts up. Where the other guy might spend 45 minutes figuring that out.

There's not enough shared knowledge, really, the knowledge is out there, but it's just not being shared.

It's when the problems hit and the machine goes down. Unless you have actually experienced the problem before, you're lost, a lot of the times you get the trades up, they've got a little more experience because they've done the actual work on the different shifts. They may run across one piece of the puzzle, you've got the other piece between the two of you, you can solve the problem.

But this idea of moving constantly isn't helping. I guess because you don't have anybody (pause)—I guess everybody has an overview of the machine. Nobody has got a real good knowledge of how that piece of equipment works and you could do that if you had one person or two people that had a good knowledge. They do have them, but they just don't use them.

There are some who just don't give a damn anymore. I think it's just that we've been trained to the point where we can just run the equipment. The fact they are constantly trying to add to workload. People don't put forward the effort. That extra effort required to be good at what you do. They just say—

JJ: "oh, the general knowledge is good enough,"

George: ...what's the sense of actually putting my time into learning something extra because I'm going to be there tomorrow? I'm not going to be here. That's why it's getting the way it's getting. People are just getting out

there, so they don't care. Because they are constantly (pause) I don't know (pause) frustrating as hell.

long pause

George: We have all the manuals to go through, but the problem is when you go through the manual you can't find the answer. Then where do you go? They have all these people in here. We have more support than workers. I mean, why don't they let us use that support? It's only, maybe a 10-minute conversation that will solve the problem. I think what it is, is you become so frustrated because they won't give you the knowledge and you find you have to work harder to gain the knowledge. If I talked to you and you knew you could give me the answer in 10 minutes. I have to work around for 2 months before I find the answer myself. I think that part of it is totally ridiculous. We have the people, why can't we share the knowledge?

Interviewer: And that's what you mean by training?

George: Yeah.

You have dozens of parameters that are set and they have a little chart on the wall that says these are the settings and you go back and set it at that anytime you have a problem, but they don't explain what those parameters do. I can take you out there and show you parameters and they mean nothing to you, but if I take you out there and show you the actual stroke and say...

Blackjack: "now it's stroking down this far,"

George: ...then it expands out so far and then it starts to stroke up and down and give you the whole process step by step and then you look at that parameter and you know what that parameter means.

Where without that basic step-by-step cycle, I guess you would call it, you have to know the exact cycle. Then you can relate that parameter to whatever it happens to be. Where they never showed us that.

JJ: "You have those parameters, that's something over there for the trades to deal with."

George: You should know what each (pause), and unless you do (pause), you have to find out the hard way. They give you a basic operating knowledge, it's like the last time I went out there. When they originally put it in I was fortunate to spend two days with a fellow from [Okono]. Then he went back and that was the end of the training. I came off that job and went back to my regular job for 6 months. And then I went back and I stayed with the guy who was there for 3 days. That's my whole training on that hone and I think it's a joke.

You have worked on all this equipment over the years, you got a general idea of how all this stuff works, so you put it together and you can run the thing. But, we can run it so much better with that extra little bit.

Interviewer: Do you enjoy your job?

George: I used to. I don't any longer. Only because of the frustration. It's got to the point where nobody has got the time to enjoy it. You can work out there now and because of just the size of the line alone you're isolated. You might be able to see only one guy in the whole 8 hours or two guys. The next guy might be two city blocks from you. The way that line is laid out.

It's not like before, you all worked in a confined area and there was more of an involvement, more of a team. Out there, you don't see it, but it's an isolation thing. Plus, I guess as you get older, you can't deal with the frustrations as easy as you could.

Researcher: Thanks, George. Your worst case seems very frustrating. Perhaps educators in the audience today will empathize with your situation and take steps to prevent learning activities from playing out in this way.

George, JJ, and Blackjack walk to the front of the stage. Blackjack on the left. JJ at the center. George on the right.

Audience Reflections

Researcher: Take the next few moments to think about each of the workers. How Blackjack, JJ, and George describe learning activities?

Are their stories that different from the stories that Jean, James, and Rufus told? As you'll recall Jean, James, and Rufus worked on established equipment that had been in the plant for a number of years. Blackjack, JJ, and George described situations where they learned to run relatively new equipment.

pause

Researcher: *(Suggests that audience applaud by raising arms somewhat and making clapping motions.)*

Blackjack, JJ, and George exit.

The interviewer goes to each chair and collects everyone's scripts. Then he goes to the researcher and gets his script too. He climbs down from the stage and into the auditorium. He takes the scripts and hands them to various people in the audience. He then exits at the rear of the auditorium.

How These Six Workers Describe Learning

Researcher: I hope that each of you has been drawn into the experiences of Jean, James, Rufus, Blackjack, JJ, and George. Hopefully, you have a better understanding of and empathy for their learning activities. Thank you for participating in this educational activity.

Researcher exits.

Researcher Reflections II: Learning to Write

Learning to write my thesis was one of the most frustrating experiences of my life. It took forever. I felt like I was going in circles, around and around and around, getting nowhere. The available information was endless; there was always more, something newer, a different aspect. I didn't feel confident. At times, it would have been very easy for me to just call it quits.

I had to try all sorts of motivational tricks in order to keep myself moving. I set goals of so many hours per day and "rewarded" myself mentally when I achieved the goals. I tried novel approaches: writing longhand, recording on tape and then transcribing, making novel use of computer programs. Unfortunately, these efforts increased my frustration. I was making greater progress, but I still felt like I was going in the wrong direction.

When it comes to learning, what is the right direction? What would have been a more appropriate direction for my learning to write my thesis proposal? What aspect of my original learning strategy was failing me? What lack of understanding about learning might have been impeding my progress?

In this essay, I examine my original strategy and try to uncover my associated assumptions about learning. I will trace how I began to discover an aspect of learning that was missing from my understanding and then how I came to a more complete understanding of learning that was available to me, and in a sense, known to me all along. I will reflect on my current understanding of learning from the points of view of learner, friend, and teacher. Finally, I will

uncover the trap that I fell into, a trap that I believe that many others have also fallen into, when I set out to learn to write.

My original strategy involved gathering information and seeking advice. I found books, journal articles, web-based courses, and advice from colleagues about writing in general and writing proposals in particular. The problem with this strategy is that it is so easy. In the computer age, there is no limit to finding and gathering information on almost any topic. I gathered stacks of articles and books. They all had slightly different approaches; I tried them all. The information alone did not help me.

I assumed that learning was receiving information or instruction. My approach was very technical.

During my early reading I noticed that learning could be examined from three aspects: technical, personal, and social. Learning is technical in that it involves strategies and techniques. Learning is personal in that it requires motivation; involves positive and negative emotions; and prompts feelings of achievement, frustration, or failure. Learning is social in that others are often involved in our learning, especially as we learn on the job; we learn from each other.

The importance of the social aspect of learning caught my attention. I realized that I had seen my relationship with Michelle, my thesis supervisor, as a hierarchical one. I had gone to her for approvals, for judgement. I had attempted to avoid wasting her valuable time. This started to change when I asked for her advice about getting a tutor. “Isn’t that my role, Guus?” she replied. Michelle was

experienced with the writing process. She had written many essays, journal articles, a master's thesis, and a doctoral thesis. I began to see her as someone who was there to help me to enter her community of practice. I began to realize that I would be unable to enter without that help. I needed to develop a learning relationship with Michelle, an important social aspect of learning.

In spite of how it helped me to a more complete understanding of learning, the technical-psychological-social framework seemed artificial.

One day as I was working on my findings, I was asking myself, "How do these workers define learning and the related terms such as teaching, knowledge, etc.?" Somehow it seemed to be different from the established definitions. My thesis committee had a sense of this too when they suggested that I define these terms in the context of the workers' particular learning situation.

I went to the Merriam-Webster's Collegiate Dictionary (10^{th} ed., 2001) and wrote out the definition of learn—to gain knowledge or understanding of or skill in by study, instruction, or experience—in the framework in Table 2.

In an "ah-ha" experience, I realized that the toolsetters had spoken mostly of learning by experience—being shown versus working on their own. They spend most of their time in cells 3, 6, and 9 of the above table. My problem in learning to write had been a lack of experience. I had spent most of my time in cells 1, 4, and 7 and the rest of my time in cells 2, 5, and 8. I sensed the need to work with Michelle, the social aspect that I talked about earlier, so that I could gain that experience. I realized that it wasn't just a social aspect of learning that I

Table 2

Framework of Merriam-Webster's Definition of "Learn"

Learn:	by study	by instruction	by experience
To gain knowledge	1	2	3
To gain understanding of	4	5	6
To gain skill in	7	8	9

was lacking; I was lacking a broader aspect—experience. I needed to be in cells 3, 6, and 9 in order to experience "experience." I needed to focus on "learning as process (rather than end product)" (Merriam & Caffarella, 1999, p. 250). I needed to focus on "something which the learner does" (Dewey, 1916, p. 335), instead of on "the sum total of what is known, as that is handed down by books and learned men" (pp. 334-345). I needed to focus on experience.

Experience means "direct observation of or participation in events as a basis of knowledge" (Merriam-Webster, 2001, p. 408). A major part of the toolsetters' experience comes from social interaction. A major part of the experience that I needed should have come from social interaction. I needed to observe the writing process. I needed to participate in it with others. I needed writing experience. The dictionary had the solution to my problem of understanding learning. "Dictionary definitions are not 'proper meanings' but succinct statements of consensual meanings" (Kane, 2000, p. 244). People in general understand learning as involving study, instruction, or experience. The toolsetters' understanding of learning emphasized experience—being shown. My initial understanding of learning had an emphasis on study and instruction—reading and being taught. But I came to realize that I lacked "being shown." I lacked a social experience.

As a learner, I now realize that learning includes elements of study, instruction, and experience. I will continue to get information and instruction, but in future I will seek to add to my experience. In the case of writing, this might involve joining a discussion or writing group with my peers in the MEd program.

Writing is learned from the guided experience of actually writing. Study and instruction are necessary but not sufficient.

As a friend, I now realize the importance of relationships. Relationships are rich experiences in themselves and the source of the rich experiences of others.

As an educator, I now realize that I am not my students' only source of learning activities, their only educator. I help them through instruction and perhaps participative learning. They choose to study. They learn from coworkers, incidental experiences, management and unions, and self-directed learning—mostly outside their relationship with me. As an educator I need to be aware of the fact that most learning occurs away from me and outside my classroom. I could easily fall into the trap of thinking that because all teaching involves learning, that learning only involves teaching and only one teacher.

But, formal teaching is not essential to learning. The following observation on the Chinese representation of learning comes from Peter Senge (Senge, Kleiner, Roberts, Ross, & Smith, 1994). The Chinese characters shown in Figure 1 represent the word "learning." The first character is a symbol of gaining knowledge above a symbol of a child in a doorway. This is the "what" part of the definition of learning used in this study— "to gain knowledge, understanding of, or skill in" (Merriam-Webster, 2001, p. 661). The second character shows a symbol for flying over a symbol representing youth. A bird learning to fly. This represents the "how" part of the definition—"experience" (p. 661). Like a bird learning to fly, that's what learning means to me as I learn to write.

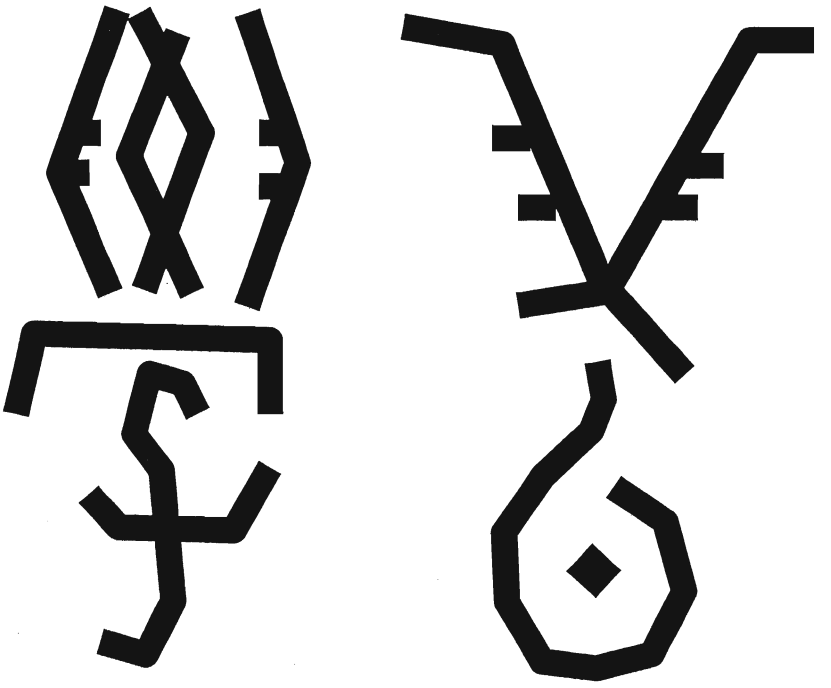

Figure 1.

Learning represented in Chinese characters.

And that's what learning possibly means to the six workers in this study. Learning is experience. Study and instruction can help, but just as in the Chinese representation of learning, study and instruction are barely present in the six workers' and my understandings of learning. Our focus is on experience. If we're not "shown properly"—by instructors, coworkers, management (or unions etc.), incidental experiences, and by ourselves—we "learn the hard way."

CHAPTER FIVE: DISCUSSION AND IMPLICATIONS

In the first researcher reflections chapter, I introduced the reader to a little boy. He thought that his parents learned to speak English solely through the activity of being taught by a teacher. Since he saw no other teachers around, he imagined himself to be his parents' teacher. He grew up to become a trainer who tried to help workers learn their jobs solely through training and trainer directed activities. He overlooked other types of educational activities and other types of educators that influence learning and that were already present in the workplace.

In chapter 2, I reviewed literature on shop-floor learning. I developed a typology of shop-floor learning activities by synthesizing various theoretical frameworks. The typology uses the primary educator as a way to categorize shop-floor learning activities. Instructors, other participants, management, experience, and the learner himself or herself can all be educators on the shop floor. When the educator is an instructor, the resultant educational activity can be described as on-the-job training. When other participants educate, then the activity can be described as participative learning. The management or union sponsors educational advertising. Safety campaigns are an example of educational advertising that pertain to the shop floor. Experience itself is the educator during incidental learning activities. And finally, when the educator is the learner, the learning activity can be described as self-directed learning. Various cases were developed from the literature to show that these learning activities can all be present on the shop floor.

The purpose of this study was to determine how six workers in an industrial setting and I in my academic setting describe our shop-floor learning activities. From our descriptions, I identified the various educators and learning activities in these settings. I

have described my learning activities in the Researcher Reflections chapters: "Learning Engels" and "Learning to Write." You met the six workers in chapter 4: "Findings." You listened to their stories, as a group and individually. And now you know how we describe learning. You were hopefully drawn into their experiences as you read and participated in the reader's theatre script. To a certain extent, you experienced a form of a "participative learning" activity as you read my narratives—I was showing you.

The purpose of this chapter is to explore how these six workers and I describe our learning activities on the shop floor, to point to some theoretical developments for this work, and to express some hopes and implications for the future of shop-floor learning

Discussion

Ways The Six Workers Learned

These workers all experienced on-the-job training, even if it was "just the basics," when they were new to a job. Even though it takes a year or two to learn their jobs, on-the-job training often lasts only hours and in some cases days.

Participative learning is a major learning activity for the workers. They described "being shown [by coworkers] until they got comfortable at it."

Media and educational advertising campaigns were not discussed by the six workers.

Incidental learning is ongoing. Much of what the workers learned was through experience. As they worked with each other and worked with "the trades," they picked things up in the course of doing the work.

All of the workers have, to various degrees, taught themselves through self-directed learning. They sought to discover how they could get their machines to run smoothly.

It's been reported that workers learn 75-90% of tasks on the job (Black, Zenner & Ezell, 1996; Malcolm, 1992; Rothwell & Kazanas, 1990). The findings suggest, that most of the job-related learning activities that these six workers described took place on the shop floor. Classroom training activities represent a small percentage of the total amount of time spent in all learning activities, although half of the six workers described classroom learning.

What the Six Workers Did While They were Learning

Being shown. All of the workers use the word "show." It was used more than any other word to describe what happened while they learned. They wanted to "be shown exactly," "shown when it comes up," "shown by someone with the right knowledge," "shown when they need help." They needed to be shown by a fellow worker as problems occurred. They needed participative learning activities where they were shown as they participated in the work activity.

Learning the hard way. When they were not shown properly, the workers attempted to "learn the hard way." This is learning by trial and error. It is learning in isolation. It became more frustrating when they tried to figure something out and they knew that someone else had the answer, when all they needed "was to have a 10-minute conversation" (participative learning). "Learning the hard" way is a form of unsupported self-directed learning. Of course, self-directed learning is not always "learning the hard

way," but the workers were very aware of the times when they were left to learn on their own and they were frustrated by the lack of support and unavailability of resources.

The Importance of Books and Instructions for the Six Workers. Books and manuals were important to these workers, especially on new equipment where the other workers had not acquired the knowledge, understanding, or skill needed to operate the equipment themselves or to show the learner how to operate the equipment. Books, when necessary, were not sufficient. Often the information was not in the book. "There is too much knowledge to put into the book."

How the Shop-Floor Workers Described Why They Learned. These six workers learned in order to get "comfortable at it." This is similar to what Clardy (2000) called "the desire for easier work practices" (p. 120). They learned to get better at it because they had "a need to be seen as competent" (Clardy, 2000, p. 120) and "a desire to be full practitioners" (Lave & Wenger, 1991, p. 122). They learned in order for the equipment to run smoothly.

These workers are self-directed. They "act purposively and creatively in uncertain or unfamiliar circumstances" (Chapin, 1995, p. 65). They want to do more than simply follow instructions. They want to understand and improve. Self-directed learning seems to be one of the shop-floor-learning-activity strands that is almost always present for these workers. They are self-directed during participative learning. Rufus insisted that a coworker work with him when he needed to learn a new job. James wrote what he learned during participative learning in a little book. This activity, like many of the others, involved more than one type of learning activity, in this case participative and self-directed learning.

Best and Worst Cases of Learning Activities for the Shop-Floor Workers

"They...show me exactly," says Jean in her best case. Her worst case was due to "each person [having] a different way of doing things. And some were throwing me completely off what I was supposed to be doing." To Jean, learning involves being shown exactly. She wanted good on-the-job training and participative learning. The difference between her best and worst cases points to an organizational factor.

James, in his best case, says that "training is having someone show you, physically being there with you." His worst case involved someone who was not so supportive. "He would ridicule anything that was left over," anything that James didn't finish on his shift. To James, good learning involves someone being there, participating with you.

For Rufus's best case, people "took their time showing you how to run the line." His worst case involved an uncooperative fellow worker: "one of those trial and error guys." To Rufus, learning is people taking the time to show you, which is participative learning.

To Rufus, James, and Jean, good examples of learning involve being properly shown by more experienced workers around them. These three workers operate established equipment where there are experienced people available who can show them. The other three cases involve workers who described work on new equipment.

Blackjack's best case is one where, "we had everything, we had the training, we had on-the-job training, we had references, we had manuals to go to...when [CNC] came in I was involved." When the [Okono], his worst case, "was installed, [they] bought the machine, brought [it] into the plant, [and said,] 'here you go, run.'" The major difference

between his best case and worst case was the difference between being involved and working in isolation. Good learning for Blackjack is being fully involved, fully participating, that is, participative learning.

In JJ's best case, "We were all fortunate to get a lot of travelling and training with the vendors, and take courses." He was helped one-on-one by "a very calm person," with "lots of patience." In his worst case, "somebody shows them the basics to get by. That's it." To JJ, learning is being shown much more than the basics and being shown by calm, patient people. He described on-the-job training and participative learning.

For George's best case, "between all of us down there we were all back and forth, it was like a little family, if you have a problem you can talk to so-and-so—he may have come across it before—there was an exchange of information." In his worst case, when he tries to talk to an engineer: "that engineer is never contacted, you never see anybody, it's like they are hearing you but not listening to you." To George, learning is the back and forth exchange of information, it is participative learning.

For these three, learning is not only being properly trained, but also being involved, participating, sharing information. With new equipment, training may be necessary initially, but once the initial training is complete, just like with the other three workers, learning also evolves into being properly shown by other workers. Training activities are a way to get started until there are people who are able to work together and show each other how to complete their tasks through participative learning activities.

The difference between everyone's best and worst cases involves an organizational factor: the careful planning and delivery of learning activities. For on-the-job training, this means "a planned process [that] involves one on one [sic] workplace

learning that utilizes training objectives and plans, active guidance by a trained peer or supervisor, job aids, printed materials, and a systems approach" (Jacobs, 1992, cited in Black, Zenner, & Ezell, 1996, p. 590). During participative learning and self-directed learning activities, theorists and training managers advocate the importance of making people and materials available to the worker when the worker needs to learn (Knowles, 1985; Malcolm, 1992). This requires careful planning for the delivery of learning activities. Educational advertising can make workers aware of shop-floor issues and concerns like following standardized methods. This type of reminder to Jean's coworkers might have resulted in their showing her the job more consistently, thus avoiding her frustration. The organization needs to ensure that those showing learners know their jobs, and that they have the opportunity to share this knowledge and skill with new workers. The organization also needs to ensure that people and materials are available to the learner when the learner identifies learning needs.

How These Workers Described Shop-Floor Learning Activities

These workers described multiple shop-floor learning activities. On-the-job training, participative learning, incidental learning, and self-directed learning are all present. Participative learning seems to be especially important because of the need to "be shown." For these workers, learning activities are multi-faceted, involving being shown through training activities, participative learning activities, and through practice. Best cases involve the organization carefully planning and delivering the learning activities. This is not so for their worst cases.

Expressions relating to "being shown" were used more than any other. All of the workers described this phenomenon. An important aspect of learning is "being shown."

The workers also all referred to the phenomenon of "learning the hard way," that is, not being properly shown. All of them also described situations where they either participated or did not participate with people around them.

All but George described the concept of "getting comfortable at it." As you'll recall, George was not yet at that stage. He was not yet at the "comfortable at it" stage in his worst case situation. We can surmise that he likely was comfortable in the [Die Cast], his best case situation. It is fair to say that when we are "comfortable at it," we have learned to perform the job at the level of performance that we desire.

Books and instructions are helpful at times, but they cannot "show you." There are things you cannot find in a book.

Good cases include wonderful examples of participative learning. Learning that involved being properly shown by coworkers. During bad cases, participative learning was usually absent, workers were not being shown or not being shown properly—they "learned the hard way."

Ways I Learned on My Shop Floor

Now that I've described how these workers describe their learning, I will describe my own learning.

I received some on-the-job training from my thesis supervisor. She told me what to do and I did it. For example, she told me how to format the proposal document.

When she took on the role of "co-worker," I experienced participative learning. The cycle of rewriting and revising involved participative learning to a large degree.

My learning to write involved educational advertising as well. I bought several books related to this study through an on-line bookseller that regularly lets me know about new authors and books that might be of interest to me.

I discovered that writing is more perspiration than inspiration. Some of what I learned could be described as incidental learning. My wife is a school librarian. When I was helping her do some Internet research on Roald Dahl, I discovered some helpful writing tips from Dahl's official Web site (www.roalddahl.com).

Most of my learning was what would be described as self-directed. No one was instructing me or participating with me, but I was trying to learn. I was the primary educator during these activities.

In summary, in learning to write I experienced every aspect of the typology of on-the-job learning activities. Like the six workers, my learning activities were multi-faceted.

What I Did While I was Learning

At the early stages of this thesis I "learned the hard way." Much of my writing involved trial and error. Much of it was perspiration versus inspiration. However, I would have had an easier time of it had I asked my professor, fellow students, and colleagues if they wouldn't mind taking the time to "show me" how they write. More opportunities for participative learning would have helped me early on.

Recently, my learning has been very participative. My thesis drafts have numerous examples of being shown. Examples include suggested wording for a sentence, complimentary phrases where I got it right, and comments in the margins explaining the reasons behind a suggested edit.

The Importance of Books and Instructions for My Learning. I valued books and spent a lot of time looking for "the way to do it" from books. A book can be very useful because it can describe how to do something. Three or four books that all describe different ways of doing something can be very confusing because they cannot tell you which to choose. For that, you need more than a book.

This research has relied on books and referred to books and articles, it has been an "academic effort in many respects." But it wasn't just academic. I think back to a comment James made about academic types. "Personally, I'm a person who wasn't really interested in academics, per se." And I discover that he's not the only one who used the word "academic"—the NUD*IST program makes it so easy to find and organize people's words. Here's what Rufus wondered:

> Does a university-educated person learn it quicker than a highschool-educated person? Or did a highschool-educated person not go to university because he's a "hands-on" guy and university doesn't teach that? A university-educated guy might say I'm all academics, but I took the wrong course so here I am working here.

Rufus was referring to shop-floor learning when he said this, but he may have touched on something more general. I had a problem when I was "all academics." Learning to write, like learning to toolset, also involves "hands-on" activities.

Why I Learned. I learned because I wanted to get "comfortable at" writing. Writing is hard work, and I don't expect it to ever be easy. But hard work, for me, is manageable when I know what to do without wasting unnecessary time and energy (learning the hard way).

I also learned because I wanted to finish the thesis. I wanted to be proud of my work. I wanted to overcome the challenges. I wanted to join the research community.

Best and Worst Cases of My Learning Activities

My worst case learning activities occurred when I began this project, when I thought that study and instruction would be sufficient for learning to write this thesis. I thought learning was "all academic" and my educators were solely my instructors or other educational researchers.

My best case is described in my second Researcher Reflections section. It occurred when I realized that learning involved multiple learning activities and that it was perfectly acceptable to develop a "working" relationship with my project supervisor. I felt that I was really learning when I realized that my project supervisor was fully prepared to "show" me how to write. My learning activities included instruction, participating, experiencing, and constructing.

How I Describe My Shop-Floor Learning Activities

My shop floor, as I learned to write this thesis, included everywhere other than my university classrooms. My classroom learning was completed. I had taken all of the required courses and I began the final requirement for my Master of Education degree.

My shop-floor learning activities included all of the ones described by the six workers in my study. My advisor gave me on-the-job training, sometimes in her office, sometimes over the telephone or by email. This training involved instructions on where to

go for information, on specific articles that I should read, on how to format this document, and other relevant topics.

Lately, my advisor has also acted more like an experienced co-worker. She has guided me through participative learning. She has shown me, for example, how she stays motivated through the long and tedious rewrite process.

I have not had a lot of contact with fellow students. I could have learned a lot by having them show me. My participative learning was wanting because of this.

Some of my learning was incidental. I've mentioned Roald Dahl's internet site. I was helping my wife prepare for a grade 6 class on Roald Dahl. There was some excellent advice for me. I learned of the importance of having a regular writing routine and sticking with it. I also discovered the tip that you should always stop on a high note, and thus look forward to getting back to writing the following day.

Much of my learning was self-directed. This learning activity was sometimes present in conjunction with other types of learning activities. I went to the library looking for writing advice (on-the-job training). I asked my advisor how she motivates herself (participative learning). Often, however, my learning was just self-directed. In some of those cases, if I knew what to do, things went well. Here I was learning as I practiced writing. I was comfortable with parts of the process and made progress on my own. When I didn't know what to do, I "learned the hard way." I felt really low during those times.

More than anything else, I wish I had been shown what to do. I didn't want this research done for me, but I would have liked others to show me how they did theirs. For example, I wanted someone to show me how they took notes and organized articles. (I

used NUD*ist to do some of this for me, but there may be other ways to index and sort academic research.) As a result of not being shown, like the six workers, I "learned the hard way."

I learned from books. I would fit this into the categories of on-the-job training and self-directed learning. Perhaps, on my shop floor, there needs to be a separate category for scholarly work because of the number of learning activities that involve reading and interpreting in the form of books and articles. To stay consistent with my typology, when learning from a book, one learns from the person who wrote the book. In this sense, learning from a book can be on-the-job training, if the person is an instructor. It could also be participative learning, if the book or article is describing someone's experiences. For example, Wolcott (2001) had excellent advice on writing up qualitative research—this was on-the-job training and participative learning. As you can see, the categories in the typology do overlap, but they help focus on different aspects of the learning. All that said, books alone are not enough. Sometimes there are too many books. How do you decide which one to focus on? How do you decide when to stop reading? Having someone guide your reading can help immensely. There were many occasions when my advisor suggested that I stop reading and start writing. On the other hand, there are also many examples of occasions where she recommended that I seek additional sources. I found her guidance to be very helpful.

Educational advertising is a category that I have also experienced. The Chapters bookstore sends me information on books that might be of interest. The university graduate student society invites me to join in various activities. The university itself

makes me aware of various courses and seminars. Even our school motto, surgite, is a form of educational advertising. It reminds students and writers to "press on."

Learning activities come in a variety of forms. I created a typology that includes five types of educational activities. I found that the more multifaceted and complementary my learning activities, the more my learning progressed.

My Understanding of Learning Influences My Narratives

My understanding of shop-floor learning has evolved and this evolving understanding has influenced my narratives—my own and the six workers'. I outline below my changing understanding of shop-floor learning and show how changed understandings influenced the narratives. Refer to Figure 2 on the next page.

In Figure 2, I use the analogy of a pipeline. Learners are represented by water as it flows through the pipeline. Educators help move the learner along. Learning activities are represented by sections of the pipe. The product of the activities is labeled "Outcomes" at the end of the pipe. The figure shows two types of pipelines. One has a single strand or channel, the other has multiple strands or channels.

When I began to write this thesis, I thought that learning activities were multi-stranded. I thought that learning involved more than just training activities. But as I've reported in "Learning to Write," I initially pursued only instructional activities as I learned to write this thesis document. Even though intellectually I knew that learning involved more than training activities alone, I behaved otherwise. My behaviour points to what I actually believed. When I began, I really thought that learning involved a training process. This is shown at the item labeled "1" in the figure. In this stage, I thought that

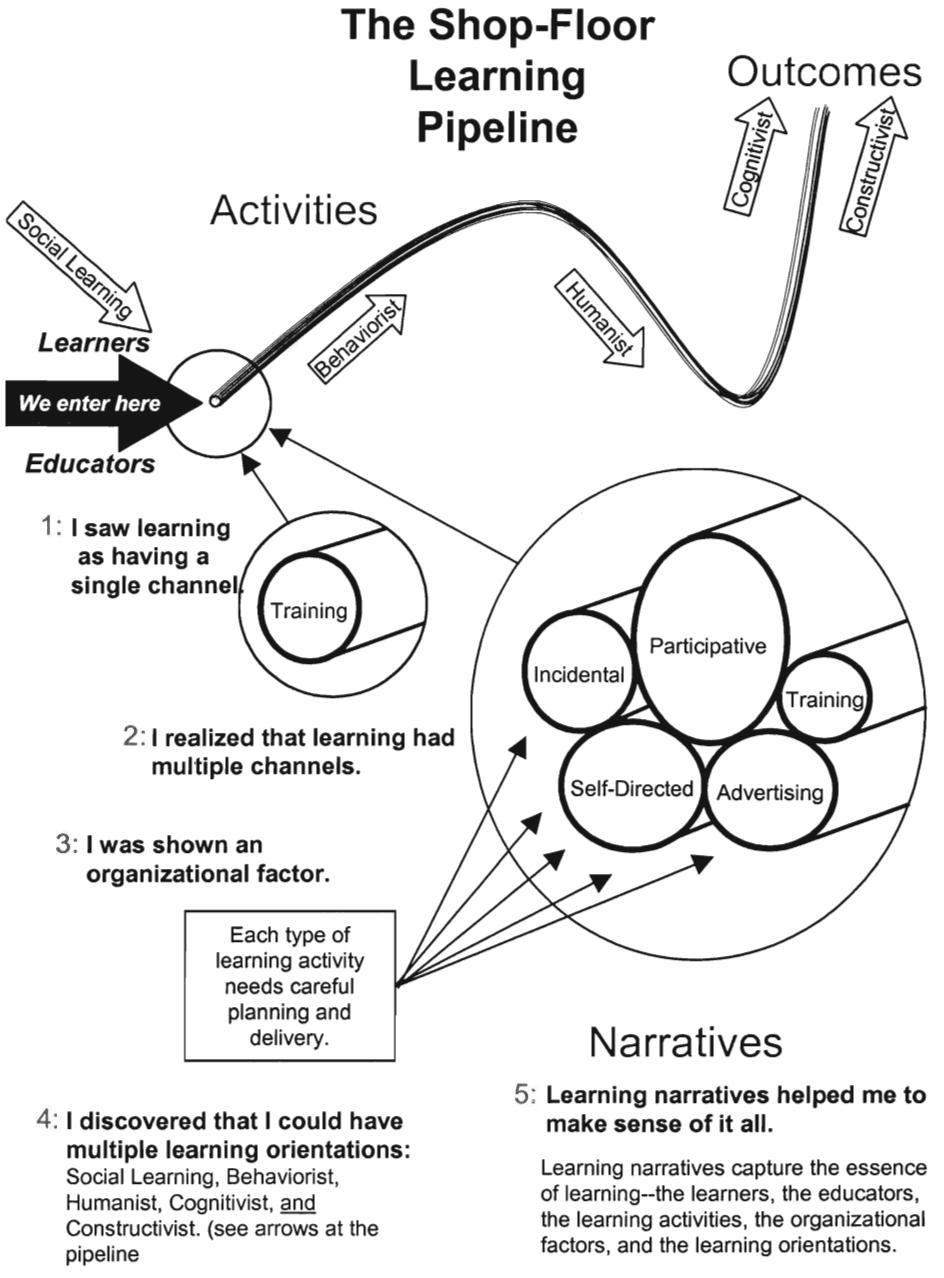

Figure 2.

My Evolving Understanding of Learning

learning activities were basically all alike, that they were single-stranded and intimately tied to training activities.

Then I discovered that, like the six toolsetters, I too, could be involved in participative learning. My thesis supervisor could be more than an instructor, she could show me how she wrote or how she maintained the necessary motivation to write. I also realized that, in addition to my thesis supervisor, the other members of my thesis committee have participated with me in developing the ideas in this document. I learned with them. When I needed to "press on," they encouraged me. This is shown at the item labeled "2" in Figure 2. In this stage I realized both intellectually and behaviourally that learning activities are multi-stranded. I learned to write through on-the-job training activities and participative learning activities and incidental learning activities and educational advertising activities and self-directed learning activities.

As I mentioned, a member of my thesis committee showed me that there is an organizational factor present in the workers' narratives. I initially didn't see it. Learning activities need to be carefully planned and delivered. This seems obvious, but it simply is not the case in many of the examples from the six workers. Careful planning and delivery is likely required for any type of learning activity. Further research might identify the components of carefully planned and delivered learning activities. I speculate that these components are most likely present in good examples of each type of learning activities in my typology. When I went back through the findings chapter I found comments relating to the design and delivery of learning activities mentioned 38 times. Other related factors were also mentioned. Matters affecting the feelings of the workers were mentioned 34 times. Knowledge was mentioned 25 times, time was mentioned 24 times,

and having help available was mentioned 15 times. All of these things relate to good program planning and delivery (see Cafferella, 1994).

The thesis defense process is an organizational factor that influenced my learning to write. The review process has enabled me to learn from my entire committee as they provide comments and suggestions on my thesis drafts. The thesis defense process is evidence of a planned element of my Master of Education Program.

At the item labeled "3" in the figure, I discovered that there is an organizational factor—proper planning and delivery of learning activities—that is necessary for successful learning to take place.

My thesis supervisor asked during a review of a recent draft, "Do you believe your definition of learning?" "What is there to believe?" I thought. Her question confused me, and I returned to learning theory literature. Learning theorists often make reference to orientation to learning (Cranton, 1992; Merriam & Cafferella, 1999). I was never able to choose an orientation for myself. I sometimes was behaviorist, sometimes cognitivist, usually humanist, sometimes social, and almost always constructivist in my orientation to learning. Some orientations lend themselves to some learning activities better than to others. For example, a behaviorist orientation lends itself to training activities and a social learning orientation lends itself to participative learning activities. I believe in multiple learning activities, why not also in multiple orientations? I don't have to choose one. Merriam and Cafferella (1999) have a table (p. 264) that compares five orientations to learning.

Here is what they describe as the teacher's role for each of their five orientations to learning.

Behaviorist:	Arranges environment to elicit desired response.
Cognitivist:	Structures content of learning activity.
Humanist:	Facilitates development of whole person.
Social Learning:	Models and guides new roles and behavior.
Constructivist:	Facilitates and negotiates meaning with learner.

When I reward myself for completing a task or promise myself a future reward for completing my Master of Education program I have a behaviorist orientation. As I structure the content of this document, I have a cognitivist orientation. I attempt to organize the document so that readers will follow my arguments. Wanting you to become a better educator results from my humanist orientation. When I see my committee as role models, I have a social learning orientation. Finally, as we facilitate and negotiate the meaning of learning, my committee and I have a constructivist orientation. These orientations shape my learning activities. I believe that everyone might have different preferences for the various orientations to learning, but whatever the preferences, all of the orientations involve learning. This is shown at item "4" in Figure 2. In Stage Four I realized that I believe in multiple learning orientations.

I thought that orientation to learning was an academic issue. Educators talk about orientation to learning. Do workers allude to it? When I turned to the readers' theatre narrative, I found that the six workers each provided hints about their orientations to learning. For example, George appears to alternate between a humanist ("It's so frustrating because you're trying to do the best you can do..."), a cognitivist ("It's finding the information and there's a total lack of it."), and a social learning orientation

("Between all of us down there we were all back and forth, it was like a little family, if you have a problem you can talk to so and so") .

The readers' theatre narrative provides good clues to, not only George's orientation to learning, but to the other workers' orientations as well. The narrative retained the "experiential whole" (Clandinin & Connelly, 1991) and as a result allowed me to go back and discover aspects that I had not noticed earlier. Learners' narratives are themselves educational. This point is labeled "5" in Figure 2. Here I realized that learning narratives help learners and educators make sense of it all.

This is my learning narrative, I used reader's theatre to tell the workers' stories and my reflective chapters to tell mine. The reader's theatre and second reflective chapters were written when I was at item "2" in Figure 2—when I thought of learning activities as simply having multiple strands. In this chapter, which was written after a considerable amount of reflecting and revising, I am at stage "5" in Figure 2. Now I believe that learning is multi-stranded, that it requires careful planning and delivery, and that it is supported by multiple orientations to learning. I also believe that learning narratives will make a significant contribution to the field of adult learning because learning narratives help learners and educators to make sense of it all.

Theoretical Developments

I have provided insider accounts of how people describe their shop-floor learning activities. The bulk of the accounts come from six industrial workers who describe their shop-floor learning. I have identified interesting parallels between their learning and my

learning. Our learning is multifaceted. There are multiple educators involved in our learning. Participative learning activities have a powerful influence on the overall learning effort. Sometimes educators, although present, are underutilized. All of these findings are evident in our stories describing shop-floor learning.

Not only is shop-floor learning multi-stranded, but the individual strands of shop-floor learning require careful planning if organizations don't want their members to "learn the hard way."

An unexpected development involves orientation to learning. Through these narratives, I have shown that multiple orientations to learning exist within workers on the industrial shop floor, as well as within this researcher on his academic shop floor. People don't have to "identify their own theory of learning and discover the strategies for facilitating learning that are most congruent with their theory" as Merriam and Caffarella suggest (1999, p. 265). Multiple orientations to learning can coexist within educators and workers on the shop floor.

Narrative research and reader's theatre contributed toward these discoveries. Reader's theatre enabled you to hear the insiders' accounts in full and with their words. This is an important process and I recommend it to others who intend to research learning and learning activities.

Implications

Logically, people know that learning involves more than training activities. It just makes sense. It not only makes sense as we analyze learning activities, but it makes sense

as we examine the common learning narratives that all people share—learning to speak, learning to write, learning to operate equipment. People realize that learning activities are multi-stranded. In practice however, participative learning, incidental learning, and self-directed learning experiences were frustrating not only for these workers on the shop floor, but also for me "on my shop floor" as I wrote this document. In practice, the educators at ACME Marine paid more attention to training activities than to other available educational activities. And even training was not always planned or delivered well. Also, in practice, my educational program resulted in my learning to write this thesis mostly "the hard way." Likewise some of the cases from the research demonstrate that educators also have focused on shop-floor training. Shop-floor learning could be enhanced if more attention was paid to the whole spectrum of learning activities that occur on the shop floor. The following implications are speculative and not empirically supported by the findings in chapter 4.

For Workers

As the reader's theatre presentation demonstrates, workers' shop-floor stories are compelling. Narrative describes, and it also engages. Workers should benefit if their stories are told and heard. Narrative describes the whole situation and the whole person in that situation. Understanding a whole situation enables educators to make logical choices. For example, I have identified multiple learning activities. It is logical to create an environment that supports all of these learning activities. This research has raised your awareness about alternate ways of supporting learning. But this research has also presented the person inside the learner. Meeting the person may result in emotional

commitment. Readers may respond to this research because they feel committed to helping these six workers and this novice researcher or others like us.

For Graduate Students

Graduate students should engage in participative learning. They should ask their fellow students and professors to show them their writing and their research, not just tell them about it. Students should also develop supportive networks of fellow students, and professors. People with knowledge and experience are there to be found, but their knowledge can only be shared if you get to know them, and ask them for help.

In addition, keep in mind that learning is more than study and instruction, it is more than "academic." Learning involves multiple types of shop-floor learning activities. "In its most general sense, when one asks what it means to study education, the answer is to study experience" (Clandinin & Connelly, 1994, p. 445). Some things you can be shown through experiences of on-the-job training, participative learning, and perhaps educational advertising, but many you'll have to learn "the hard way," on your own through incidental learning and self-directed learning.

For Supervisors of Workers and Graduate Students

Malcolm (1992) thinks that the focus needs to be on the "100 percent learning event," which he defined as:

> one that includes some traditional elements of training and a whole lot of support for people while they try to apply new skills on the job. The learning event isn't over until the skill has been successfully applied to real work. (p. 59)

Jean, James, Rufus, Blackjack, JJ, George, and I all describe vivid experiences where we could have used more support on the job. Yes, there were examples where people could have been better trained, but for the most part these workers are asking for help during the experiential aspects of learning, not the instructional aspects. Supervisors can enable participative learning. They can work to create a work community where people work and learn together.

There is an increasing need for worker expertise. As you'll recall, the jobs these workers have learned to do are complicated. They have become expert at keeping their equipment running smoothly. Recall the following from chapter 2:

> A worker's ability to solve problems, or even the number of times in a day that she is called upon to solve them...comes from the worker knowing who to turn to when she does not have an answer, what to keep an eye on to make sure that everything is operating smoothly, and when to make adjustments in what she is doing. This is true whether she is tightening a nut, watching the ink level of a press, or creating a precision part with a CNC. The mental labor required of workers in the three industries studied [machining, automotive repair, and printing and graphic arts] is taking the place of much of the brute strength and manual work required in the past. (McGraw & Forrant, 1992, p. 8)

These six workers confirm this assertion. As a specific example, here is what George said when he was discussing why he needed to understand the parameters of his machine. He describes equipment that is very complex.

> You have dozens of parameters that are set and they have a little chart on the wall that says these are the settings and you go back and set it at that anytime you have

> a problem, but they don't explain what those parameters do. I can take you out there and show you parameters and they mean nothing to you, but if I take you out there and show you the actual stroke and say "now it's stroking down this far, then it expands out so far and then it starts to stroke up and down" and give you the whole process step by step and then you look at that parameter and you know what that parameter means.

This expertise is gained on the shop floor. Supervisors should consider all of the learner's learning activities, in addition to ensuring that the worker receives proper training.

For Educators

Those of us in practice need to address all of the learner's learning activities. Do learners have people and references to go to for answers to their questions? Are there people that learners can observe? Do people work together? Is there a sense of community? Do we help the learner to learn using all of the learning activities available to the learner? Do educators properly address the design and delivery of all of these learning activities.

For Educational Researchers

This study has drawn attention to a variety of learning activities: classroom training, on-the-job training, participative learning, educational advertising, incidental learning, and self-directed learning. The works of Knowles (1984), de Jong (1996), Lave and Wenger (1991), and Clardy (2000) are all supported in some way by the stories from the six workers and me. All learning activities need attention, but not in isolation. Learning is multi-stranded, so educators need to pay attention to all of the strands.

The main purpose of this thesis was to document, in narrative form, how these workers and I describe learning activities on the shop floor. This might help educators to better understand the activities that are involved in shop-floor learning. Another purpose was to draw educators into these narratives so that they will be persuaded to help these six workers, me, and our organizations learn.

Cortazzi (2001) states four reasons for doing narrative analysis. First, narratives share the meaning of experience. In this study, my narratives demonstrate my understandings, or meanings, of learning, learners, educators, learning activities, learning orientations, and learning narratives. Second, narratives enable the representation of peoples' voices, "so that others may know life as [we] know it" (p. 386). In this study, you have learned about aspects of my life as I know it and the lives of various people in the literature review. In the findings, you met six workers and got to know life as they know it. Third, narrative reveals personal qualities: "the insider's view of what a job is 'really' like" (p. 386). In this study I revealed these human qualities in my stories, the stories from the literature, and as you read in the findings, the stories from the six industrial workers. Finally, Cortazzi sees narrative research "itself as a story...using story conventions to persuade readers effectively" (p. 387). The findings chapter is formatted as reader's theater, which is a staged dramatic presentation of people's narratives (Adams et al., 1998; Donmoyer & Yennie-Donmoyer, 1998). I can only hope that you have been persuaded by my narratives, just as you have seen how I was persuaded by the narratives of these six workers. Shop-floor learning requires our attention. I hope that future learning narratives will expand our understanding of and commitment to people's shop-floor learning.

Further narrative research might ask, "How can on-the-job training, participative learning, educational advertising, incidental learning, and self-directed learning be improved in order to enhance learners' shop-floor learning activities?"

References

Acker, S. (2000). In/out/side: Positioning the researcher in feminist qualitative research. Resources for Feminist Research, 28, 189-208.

Ackoff, R. L. (1996). On learning and systems that facilitate it. Center for Management Journal, 5, 27-35.

Ackoff, R. L., & Johnson, L. (1997). From mechanistic to social systemic thinking: A digest of a talk by Russel L. Ackoff. Williston, VT: Pegasus Communications.

Adams, N., Causey, T., Jacobs, M., Munro, O., Quinn, M., & Trousdale, A. (1998). Womentalkin': A reader's theatre performance of teacher's stories. Qualitative Studies in Education, 11, 383-395.

Argyris, C., Bellman, G. M., Blanchard, K., Block, P., Bridges, W., Deane, B., Gery, G., Kanter, R. M., Lawler, E. E., Peters, T., Pinchot, E., Pinchot, G., Senge, P. M., Tichy, N., & Wheatley, M. (1994). The future of workplace learning and performance. Training and Development, 48, 36-46.

Besser, T. L. (1996). Team Toyota: Transplanting the Toyota culture to the Camry plant in Kentucky. Albany, NY: State University of New York Press.

Black, J. A., Zenner, F. J., & Ezell, E. (1996, February). A case study of the development and implementation of a structured on-the-job training program in the coil processing industry. Academy of Human Resources Development Conference Proceedings (pp. 590-597). Minneapolis, MN: AHRD.

Boekaerts, M., & Minnaert, A. (1999). Self-regulation with respect to informal learning. International Journal of Educational Research, 31, 533-544.

Brown, J. S. (1999). Slides from AAHE 1999 Conference on Higher Education [On-line]. Available: http:///www.ntlf.com/html/sf/sf/htm

Buckler, B. (1996). A learning process model to achieve continuous improvement and innovation. The Learning Organization, 3, 31-39.

Caffarella, R. S. (1994). Planning programs for adult learners. San Francisco: Jossey-Bass.

Chapin, V. (1995). Knowledge at work: Human-centered machining technology. In C. Schenk & J. Anderson (Eds.), Reshaping work: Union responses to technological change (pp. 163-195). Don Mills, ON: Ontario Federation of Labour, Technology Adjustment Research Programme.

Clandinin D. J., & Connelly, F. M. (1991). Narrative and story in practice and research. In D. A. Schön (Ed.), The reflective turn: Case studies in and on educational practice (pp. 258-281). New York: Teachers College Press, Columbia University.

Clandinin D. J., & Connelly, F. M. (1994). Personal experience methods. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research (pp. 413-427). Thousand Oaks, CA: Sage.

Clandinin D. J., & Connelly, F. M. (2000). Narrative inquiry. San Francisco: Jossey-Bass.

Clardy, A. (2000). Learning on their own: Vocationally oriented self-directed learning projects. Human Resource Development Quarterly, 11, 105-125.

Constas, M. A. (1992). Qualitative analysis as a public event: Documentation of category development procedures. American Educational Research Journal, 29, 253-266.

Cortazzi, M. (2001). Narrative analysis in ethnography. In P. Atkinson, A. Coffey, S. Delamont, J. Lofland, & L. Lofland (Eds.), Handbook of ethnography (pp. 384-394). Thousand Oaks, CA: Sage.

Cranton, P. (1992). Working with adult learners. Toronto: Wall & Emerson.

de Jong, J. A. (1991). The multiple forms of on-site training. Human Resource Development Quarterly, 2, 307-317.

de Jong, J. A. (1996, February). Job instruction reconsidered: Usefulness and limitations of the dominant type of structured OJT. Academy of Human Resources Development Conference Proceedings (pp. 235-240). Minneapolis, MN: AHRD.

de Jong, J. A., & Versloot, B. (1999a). Job instruction: its premisses [sic] and its alternatives. Human Resources Development International, 2, 391-404.

de Jong, J. A., & Versloot, B. (1999b). Structuring on-the-job training: report of a multiple case study. International Journal of Training and Development, 3, 186-199.

Deming, W. E. (1986). Out of the crisis. Cambridge MA: MIT Center for Advanced Engineering Study.

Dewey, J. (1916). Democracy and Education. New York: Free Press.

Donmoyer, R., & Yennie-Donmoyer, J. (1998). Reader's theater and educational research—give me a for instance: A commentary on Womentalkin'. Qualitative Studies in Education, 11, 397-407.

Eisner, W. E. (1997). The promise and perils of alternative forms of data representation. Educational Researcher, 26, 4-10.

Ellis, C., & Bochner, A. P. (2000). Autoethnography, personal narrative, reflexivity. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research (pp. 455-486). Thousand Oaks, CA: Sage.

Ertmer, P. A. (1997). Common qualitative research designs. In P. D. Leedy (Ed.), Practical research: Planning and design (6th ed., pp. 155-172). Upper Saddle River NJ: Prentice-Hall.

Gahan, C., & Hannibal, M. (1998). Doing qualitative research using QSR NUD*IST. London: Sage.

Hamper, B. (1986). Rivethead: Tales from the assembly line. New York: Warner Brooks.

Kane, T. S. (2000). The Oxford essential guide to writing. New York: Berkley.

Knowles, M. S. (1984). Andragogy in action. New York: Cambridge University Press.

Knowles, M. S. (1985). Shifting to an HRD systems approach. Training and Development Journal, 39, 24-25.

Kotter, J. P., & Cohen, D. S. (2002). The heart of change. Real-life stories of how people change their organizations. Boston: Harvard Business School Press.

Lankard, B. A. (1995). New ways of learning in the workplace. ERIC Digest No, 161. Columbus, OH: ERIC Clearinghouse on Adult, Career, and Vocational Education.

Lave, J., & Wenger, E. (1991). Situated learning: Legitimate peripheral participation. Cambridge MA: University Press.

Levine, C. I. (1997). On-the-job training. Alexandria, MA: American Society for Training and Development.

Malcolm, S. E. (1992). Reengineering corporate training. Training, 29, 57-61.

Marsick, V. J. (1986, November). Informal learning in the workplace: Models of practice. Paper presented at The Adult: Models of Practice conference New York, NY.

Marsick, V. J. (1988). Learning in the workplace: The case for reflectivity and critical reflectivity. Adult Education Quarterly, 38, 187-198.

Marsick, V. J., & Watkins, K. E. (2001). Informal and incidental learning. New Directions for Adult and Continuing Education, 89, 25-34.

McGraw, K., & Forrant, R. (1992). A worker's perspective: Skills, training, and education in the automotive repair, printing, and metal working trades. Berkeley, CA: National Centre for Research in Vocational Education.

Merriam, S. B. (1998). Qualitative research and case study applications in education.—Rev. and expanded. San Francisco: Jossey-Bass.

Merriam, S. B., & Caffarella, R. S. (1999). Learning in adulthood. A comprehensive guide (2nd ed.). San Francisco: Jossey-Bass.

Merriam-Webster's collegiate dictionary (10th ed.). (2001). Springfield, MA: Merriam-Webster.

Mezirow, J. (1981). A critical theory of adult learning and education. Adult Education, 32, 3-24.

Richardson, L. (2000). Writing: A method of inquiry. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research (pp. 455-486). Thousand Oaks, CA: Sage.

Riessman, C. K. (1993). Narrative analysis. Newbury Park, NJ: Sage.

Rogers, A. (1996). Teaching adults (2nd ed.). Buckingham: Open University Press.

Rothwell, W. J., & Kazanas, H. C. (1990). Planned OJT is productive OJT. Training and Development Journal, 44, 53-56.

Rowden, R. W. (1996). Current realities and future challenges. In R. G. Brocket & A. B. Knox (Eds.), Workplace learning: Debating five critical questions of theory and practice (pp. 3-10). San Francisco: Jossey-Bass.

Scribner, S., & Sachs, P. (1990). A study of on-the-job training. New York: National Center on Education and Employment.

Scribner, S., & Sachs, P. (1991). Knowledge acquisition at work. New York: Institute on Education and the Economy.

Senge, P. M., Kleiner, A., Roberts, C., Ross, R. B., & Smith, B. J. (1994). The fifth discipline fieldbook: Strategies and tools for building a learning organization. New York: Doubleday.

Sorohan, E. G. (1993). We do; therefore we learn. Training and Development, 47, 47-55.

Stake, R. E. (2000). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research (pp. 455-486). Thousand Oaks, CA: Sage.

Torraco, R. J. (1999). Integrating learning with working: A reconception of the role of workplace learning. Human Resources Development Quarterly, 10, 249-270.

Tough, A. M. (1979). Choosing to learn. Toronto: The Ontario Institute for Studies in Education.

Van der Krogt, F. J. (1998). Learning network theory: The tension between learning systems and work systems in organizations. Human Resources Development Quarterly, 9, 157-177.

Van der Krogt, F. J., & Vermulst, A. A. (2000). Beliefs about organising learning: A conceptual and empirical analysis of managers' and workers' learning action theories. International Journal of Training and Development, 4, 124-137.

Van Maanen, J. (1988). Tales of the field. Chicago: University of Chicago Press.

Versnel, J., Hutchinson, N. L., Munby, H., & Chin, P. (2002, May). Learning in garages: co-operative education experiences of two exceptional adolescents. Paper presented at the annual meeting of the Canadian Society for the Study of Education, Toronto, ON.

Washington, C. (1996, February). A proposed model for approaches to frontline employee development. Academy of Human Resources Development Conference Proceedings (pp. 249-254). Minneapolis, MN: AHRD.

Wolcott, H. F. (2001). Writing up qualitative research (2nd ed.). Thousand Oaks, CA: Sage.

Appendix A— Roger's Interview

This is an interview with a male millwright who has worked at the company for about 22 years. He began as an assembler and then entered the apprenticeship program. Although he is a tradesman, not a machine operator, it was convenient to use him as a test case. I know this person; he was pleased to participate in this trial interview. My words are capitalized.

The Interview

PLEASE NAME SOME OF THE THINGS YOU HAVE LEARNED TO DO ON THE JOB.

(I started taping after Roger had already described one job.)

When we're working, there's a job in the lapper area. We remove a large [machine] head in a restricted area. We have to try to balance it and pick it up flat all in the first try and then do that in reverse to put it back on.

There might be a year in between the times that you get this job.

Somehow you've got to remember, and at the same time guess at how you're going to keep it flat because it has different pickup points.

ANOTHER EXAMPLE?

I can remember when we first go into the Werths at the front of the plant in the side-gear we used to pull motors apart trying to take them off because we didn't realize there was a special speed coupling inside. After so many times of destroying the motor, somebody finally got the information on how to take these motors out. So, in a way, we were damaging them to take them off, this was maybe twelve or thirteen years ago. Eventually we had to learn to undo these couplings that we hadn't seen before. So in effect by tearing it apart, by destroying the motor, we were learning—"Oh we need a way..."

But time after time, a new guy would come into the plant and run into the same problem and someone would have to remember to go tell that guy, "Oh by the way..."

ONE MORE THING?

When I first went to the wheelabrator shop, rebuilding cages. The parts rolled through the cage. So you had to see the machine, see how it works, and apply that to what you have in the shop which has been all worn out by months and months of shot-blasting. You have to rebuild it so that the parts will go through it again.

You get your welder to tear it apart with air-arcing and then start putting in new rods. And again once I put a rod in and the parts would go through and jam up, so I put a plate in to divert them back into the line. So after making a couple of mistakes, you learn what you have to do at it. In a case like that you might be on a one or two year learning curve.

THOSE ARE GOOD EXAMPLES, I DIDN'T REALIZE THAT YOU LEARN ALL THE TIME

In the mean time, you have people saying [name] there, he'll never do that job! He doesn't have the positive attitude to learn that job. Everybody has a different learning curve. Some people literally will avoid having to take a job so they don't have to learn it.

WHAT ABOUT THESE FOUR. WHICH OF THESE WOULD YOU SAY IS THE BEST EXAMPLE OF ON-THE-JOB LEARNING?

Hoisting unique lifts.

COULD YOU DESCRIBE WHAT YOU LEARNED; WHAT IS IT THAT YOU KNOW HOW TO DO?

Learn to think ahead. You're learning different effects if you don't pick it up properly. You learn to come in here well rested, because you're not going to do a job like that tired. Some nights you'll come in and say to the supervisor, "I'm not going to do this job; it's too heavy, there are too many unknowns.

WHAT DOES THE SUPERVISOR SAY TO THAT?

They rarely argue.

DOES THAT MAKE SENSE? I CERTAINLY WOULDN'T FORCE A TIRED BOMB DISPOSAL WORKER TO DO HIS JOB.

" I'M TOO TIRED TODAY!"

"OK, OK, THAT'S OK!"

(laughter)

NOW DESCRIBE WHAT HAPPENED AS YOU LEARNED. YOU ALREADY DESCRIBED WHAT YOU KNOW HOW TO DO. BEGIN WITH TELLING ME WHY YOU WANTED TO LEARN THAT. END WITH WHEN YOU DECIDED THAT YOU WERE DONE, THAT I KNOW HOW TO DO THIS NOW.

Well, you have to do jobs like that; they come across the computer all of the time. There are jobs where you have to make a lift that you've never done before. So you have to find a comfort level in hooking up to this piece of machinery that you've never lifted before and get it to come up —be it level or straight up, and try to do it within two or three tries. Often that's what you do. You move the slings around until you get it just at that right amount of levelness to pull it out. And then you put it on a handcart or … And without damaging it at the same time.

CAN YOU THINK BACK TO WHEN YOU FIRST STARTED, YOUR VERY FIRST LIFT. WHAT WAS IT LIKE? WHAT DID YOU DO? WHO WAS WITH YOU? DID ANYONE HELP YOU?

You hoped that you could avoid the job to start off with. Because it's not something… and again. In those days I worked steady nights. On nights you're often not at 100% to do those heavier lifts.

WHEN YOU SAY HEAVY, WHAT DO YOU MEAN?

This particular one might have been 4000 pounds. After you've done those tougher lifts that are challenging and done them with again hooking and trying this and trying that and finally getting it, you get to a comfort level after two or three years of coming across that lift every lets say six or seven months.

THE COMFORT LEVEL, DESCRIBE THAT A LITTLE.

Again, you go do the job and you bring your slings and whatever else you need—shackles and eyebolts and hookup in different places, and you get good at just trying something—anything. Some people sit and plan forever and after eight hours you won't have lifted it up. Eventually someone has got to decide to try something, and then from there if that doesn't work, rearrange the different slings until you do pick it up.

You also need to have confidence in the person driving the crane when you're making a lift like that. If you don't have confidence in him, it's going to be a long night.

IS THERE ANYONE ELSE INVOVLED IN A LIFT LIKE THAT?

Typically there's a driver and a guy that hooks up. There are some people that drive that other people won't work with to make a lift. You just don't feel safe enough. Whether it's suspicion that they've been drinking or stuff like that. You know different things. Some people are just rammy and too much in a hurry. On a job like that you can't be in a hurry.

WHAT ABOUT WHEN YOU WERE LEARNING. WERE THERE ANY OTHER PEOPLE INVOLVED THAT HELPED WITH THE LEARNING?

Older tradesmen.

HOW DID THEY HELP?

They helped by showing you that time in, time out they were learning the job too. They wouldn't act like, "I've done this job a million times—this is easy!"

SO IT WAS HOW THEY ACTED—YOU OBSERVED THEM.

Yah. Some people will always come across like they know it all. But by and large, the better millwrights and the older and more relaxed ones they just realize that you're not going to remember it all. And so you have to learn to get out there with an attitude of, "Let's just go at it ." Try things until it lifts up flat.

SO EVEN THOUGH THEY DIDN'T REALIZE THEY WERE HELPING YOU, THEY WERE HELPING YOU.

Yep.

ARE THERE ANY WRITTEN MATERIALS

(short reply—can't decipher words, but I think he said no)

WHAT ABOUT THE PLACE WHERE YOU DID YOUR LEARNING. WHAT WAS IT LIKE TO WORK THERE?

Cramped. Oily. Noisy?

WHAT ARE THE PEOPLE LIKE THERE?

The machine operators were very helpful.

HOW WERE THEY HELPFUL?

Just by clearing the aisles, things like that. Realizing that it is a big job. Often on a job like that you don't want people staring at you.

WHILE YOU WERE LEARNING, DID YOU GET THAT KIND OF HELPFULNESS FROM THE PEOPLE AROUND THE TOOLSETTERS, WERE THEY LIKE THAT TOO. DID THEY TREAT YOU ANY DIFERENTLY AS A LEARNER AS THEY WOULD NOW AS A REGULAR PERSON AS A DOER I'LL CALL IT.

I don't think so.

WHAT ASPECTS CAUSED YOU THE MOST TROUBLE OR CONCERN AS YOU WERE TRYING TO LEARN THIS?

At the time, probably thinking that the job had to get done faster than I realized.

WHO PUT THAT PRESSURE ON YOU?

Myself. You do that to yourself. You think that there's so many extra parts that could be made per minute here. So you put that on yourself needlessly.

WHAT CAN BE DONE TO IMPROVE THAT?

Safety consciousness.

HOW WOULD YOU? HOW COULD YOU HAVE BEEN HELPED AT THE TIME SO THAT YOU MIGHT NOT HAVE FELT THAT CONCERN FOR PRODUCTION?

Again, that's a nine year learning curve. When you're young you think that everything is important. We're building [products] here.

LET'S SAY THAT WE'RE TRYING TO REDUCE THAT TO A FOUR YEAR LEARNING CURVE. WHAT CAN WE DO HERE. I DON'T MEAN WE AS JUST MANAGEMENT, PERHAPS UNION LEADERS OR SKILLED TRADES PROFESSIONALS, ALL WORKING TOGETHER—WE ALL HAVE AN INTEREST IN THIS. WHAT CAN PEOPLE DO TO IMPROVE THAT FEELING THAT YOU'VE GOT TO GET IT DONE FAST?

Probably say that they can only do one job at a time, so do it to the best of your ability and in a safe manner.

HOW WOULD THEY TELL YOU THAT, HOW WOULD THEY GET THAT MESSAGE ACROSS?

In maintenance, the supervisors are pretty good at that.

DID THEY DO THAT WHILE YOU WERE LEARNING?

I think so.

DO YOU REMEMBER YOUR SUPERVISOR WHILE YOU WERE LEARNING?

In those days I would have had [name].

WHAT WAS HE LIKE?

He was not a millwright. He wouldn't have even begun to understand what was going on as far as the job goes. He would just basically give the job. He was the type of person that would say, "If you don't feel safe doing it—don't do it." He showed a little bit of respect in that he didn't know my realm of work. He knew what he could do for me, but not necessarily what I was doing for him. But I don't think… You have to have a little bit of , "We're building cars," but you have to balance that with, "Let's do this safely." It cost more money when I get hurt than what this machine is down for. At the time, I don't think I had that balance.

I think that sometimes that negative attitude you have can slow you down to where you're working at a safe level anyway. And when you get old enough, you lose the negative attitude, but you're getting too old to be in a hurry, and you realize that, "In the morning I'm going canoeing." You're working to go canoeing.

I HAD MENTIONED THAT I'M FINDING OUT ABOUT HOW PEOPLE LEARN ON THE JOB, THE PEOPLE INVOLVED, THE MATERIALS USED, WHAT THE SETTING IS LIKE, HOW STRUCTURED THE LEARNING WAS—I DON'T THINK I ASKED YOU THAT.

ARE THERE ANY FORMAL STRUCTURES IN LEARNING?

No. Probably the most helpful thing a millwright ever said to me was, "Take the first bolt off and go from there." Start the job.

THAT SOUNDS PRETTY INFORMAL

Yes. Try to build your confidence over time.

WAS THAT YOUR APPRENTICESHIP?

No this was post apprenticeship. Moving from plant to plant you're into a new training curve.

SO PEOPLE TALK TO YOU ABOUT THAT?

Oh yah!

WHEN DO YOU HAVE THOSE KIND OF TALKS?

When you verbally express your anxieties about not knowing all the jobs in a particular area. And when you, maybe more than usual ask people for help, so you put in

a "help call." No one gives you any grief when you put in a millwright call for help. It's based on the fact that you need someone else to explain to you how to do the job.

THAT'S A COMMON OCCURANCE? YOU EVEN DESCRIBE IT AS A HELP CALL.

You can do it whenever you want. No one will argue with you when you put in a call for help.

And talking about getting that first bolt off, often you're working with a tradesman who didn't have the confidence to take that bolt off, and yet had the experience. So you know that people have different levels of confidence. Sometimes they're up, sometimes they're not. It depends on how everything in your life is going. Some people have weak spells where they just don't have the confidence to do their job.

DO YOU FIND THAT? YOUR PERSONAL LIFE—WHAT'S HAPPENING WITH YOUR LIFE IN GENERAL AFFECTS HOW YOU DO YOUR WORK?

Yes.

HAVE I NOT ASKED SOME QUESTIONS THAT YOU THINK ARE IMPORTANT TO FIGURING OUT HOW PEOPLE LEARN ON THE JOB? HAVE I MISSED SOME THINGS THAT IF YOU WERE DOING THIS RESEARCH THAT YOU MIGHT HAVE ASKED?

(pause)
I'VE ASKED ABOUT THE PEOPLE, THE MATERIAL, THE ENVIROMENT, THE STRUCTURES.

Maybe, "When did you first realize that you were learning on the job?" It's an ongoing process.

OK, WHEN DID YOU FIRST REALIZE THAT YOU WERE LEARNING ON THE JOB?

Probably once I finished my apprenticeship.

YOU DIDN'T THINK OF YOURSELF AS LEARNING?

In an apprenticeship, you think of yourself as in a learning program. When you finish the apprenticeship, you think that you have to know it all. And deep down inside you know you don't.

WHEN DID YOU REALIZE THAT YOU WERE LEARNING THEN?

In an apprenticeship you think you're in a learning program, But after ten years of not being an apprentice anymore and you're still coming across things daily that you don't know anything about. That's the point. We're learning constantly.

SO INITIALLY YOU THINK, "I SHOULD KNOW THAT," AND THEN YOU MATURE AND THAT'S WHY IT TAKES A LONG TIME TO FINALLY STOP WORRYING ABOUT THAT.

I read in the paper recently about all the stress university students are under. I thought to myself, "If only they know that they only have to know how to find the information not necessarily how to store it—how to find it. How to have the where-with-all to say I don't know." Often they get out of university and they think they have to know it all. That internalizes stress.

WHEN [NAME] TEACHES HER KIDS MATH, EVERYONE RUNS INTO SITUATIONS WHERE YOU DON'T KNOW WHAT TO DO, THE QUESTION SHE ASKS IS, "WHAT DO YOU DO WHEN YOU DON'T KNOW WHAT TO DO?" THAT'S WHERE YOU TRY "TRIAL AND ERROR", OR AS YOU'VE DESCRIBED "TAKE OFF THE FIRST BOLT" MAKE A DECISION, TRY SOMETHING. WHAT DO YOU DO WHEN YOU DON'T KNOW WHAT TO DO? ACCORDING TO HER THAT'S ONE OF THE MOST IMPORTANT THINGS. WOULD THAT APPLY HERE TOO?

[My son] got 55% on a math test last week. And I said , "Why didn't you ask me for help?" He said, "I thought you were angry with me." I had an interview with his math teacher the night before.

I told him that he shouldn't mix up anger with care. Even when I'm angry I still care about if you need help. So whether I'm angry or not, I'm still there to help you. The anger is that you're goofing off. The part of your character that's making you not learn that stuff in class. He's got to learn that. Right now he just doesn't want to learn. Basically he doesn't have the conviction to learn.

DO WE HAVE A LOT OF THAT AT WORK

Sure!

HAVE YOU RUN INTO THAT? WHERE YOU JUST DON'T WANT TO LEARN?

Yes. I've had years where I just wanted to get through the night. Hoping not to have a job. You get so down depressed. Just putting in time. You're not thinking about learning anything. Keep the plant running.

A BARE MINIMUM?

Yes. So when the plant's been in the state that it's been in for ten years, always losing people, you have to fight like crazy to keep you attitude up. Say ok, "Something I'm learning today will help me on my next job, when I don't work here anymore. I had that discussion with a fellow in the [department]. What you know today, you don't even realize you've been educated in over the last ten years. You weren't doing half the stuff that you're doing now. Your education level has gone up dramatically which makes you a... if you did an analysis of what you have that's of value for another job down the road if this place would ever throw you out of work, you have skills that you don't realize you've got.

HOW DID YOU COME TO REALIZE THAT?

Watching the different jobs that are in production change over the years. You realize that man, I couldn't do that. And I'm getting paid more than him. I couldn't even turn some of these machines on. So when I'm out there changing a motor for him.

SO YOU COULDN'T DO THE JOB BECAUSE IT'S SO COMPLICATED, NOT THAT IT'S BORING?

Boring is another aspect. That particular job is boring, but it was still more of a job than it was ten years ago.

HOW HAS WORK CHANGED THAT MAKES IT MORE OF A JOB?

Programmable machines. Foolproof methods for assembling things—you have to go in the right sequence. You're almost forced to do it. Some people are wired to do things different a lot. Variety. With a lot of these new machines you're forced.

It's like when I go into a Sub-shop I tell the girl that I want tomatoes and lettuce, she says, "hang on, do you want olives," I say, "no I want tomatoes."

"Yes but do you want olives?"

She won't deviate from what she's been trained to ask me. It's wired in her. She's like a robot. I recognize that and I'll do that every time.

YOU BUGGER

(laughter)

She's been trained to ask this, this, this. Not start at the other end. She's been ISOed to death.

COULD IT BE A GOOD THING THOUGH? IF YOU WERE THE OWNER OF THAT SUB SHOP, WHAT WOULD YOU DO? MAYBE THERE'S AN ORDER. THEY ALWAYS PUT THE OLIVE ON AFTER THE MAYO—THEY STICK TO IT.

I probably couldn't own a Sub Shop. (Laugh)

OK THAT'S GOOD (stopped tape)

Appendix B: REB Approval Form

Brock University

Senate Research Ethics Board **Extensions 3205/4315, Room C315**

FROM: David Butz, Chair
Senate Research Ethics Board (REB)

TO: Michelle McGinn, Faculty of Education
Gustaaf de Man

FILE: **01-001 - de Man**

DATE: **August 03, 2001**

The Brock University Research Ethics Board has reviewed the revised research proposal:

"Perceptions of On-the-job Learning"

The Research Ethics Board finds that your revised proposal conforms to the Brock University guidelines set out for ethical research.

*** Accepted as clarified**

Please note: Any Changes or Modifications to this approved research must be reviewed and approved by the committee. If so, please complete form #5 - ***Request for Ethics Clearance of a Revision or Modification to an Ongoing application for Ethics Review of Research with Human Participants*** and submit it to the Chair of the Research Ethics Board. You can download this form from the Office of Research Services or visit the web site:
http://www.BrockU.CA/researchservices/mainethicsformpage.html

DB/dvo